THE EFFECTS OF EDUCATIONAL FILMS ON STUDENT PERCEPTIONS

By

ROBERT EDWARD KREBS

A DISSERTATION PRESENTED TO THE GRADUATE COUNCIL OF
THE UNIVERSITY OF FLORIDA
IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE
DEGREE OF DOCTOR OF EDUCATION

UNIVERSITY OF FLORIDA
June, 1958

ACKNOWLEDGMENTS

The author wishes to acknowledge the help and encouragement of the members of his graduate committee, who served at the beginning of this study and those who continuedto serve on his supervisory committee, Dr. William A. Fullager, Dr. Bernard R. Corman, Dr. Charles A. Cate, Dr. Vynce A. Hines, Dr. N. Eldred Bingham, Dr. Harold L. Knowles, Dr. Myron A. Cunningham, and especially his chairman, Dr. Leon N. Henderson. He is also grateful to Dr. Douglas E. Scates for the time and assistance given on the statistics for this study.

To the students of P. K. Yonge Laboratory School, College of Education, University of Florida, Gainesville, Florida, who so willingly and cooperatively participated in this study, he expresses appreciation.

The author wishes to thank the following writers and publishers who have granted written permission for the use of their material: Dr. Earl C. Kelley, Dr. Arthur W. Combs, Dr. Abram W. VanderMeer, and the Henry Holt Publishing Company.

Acknowledgment of the research, typing, and moral support to the author's wife, Jessie Rae Krebs, is also in order.

Last, but not least, the author would like to say thank you for the consideration shown by his son, Robert, who waited until after the qualifying exams and the writing of this study before being born.

TABLE OF CONTENTS

Page

ACKNOWLEDGMENTS ii

LIST OF TABLES v

Chapter

I. INTRODUCTION 1

The Problem
Need for This Study
Background and Survey of Related Studies

II. EXPERIMENTAL DESIGN 21

Hypotheses
Tests and Their Use
Silhouette Tests
Factual Knowledge Test
All-answers-correct Test
Mental Ability Test
Statistical Treatment of Test Results
Limitations

III. PROCEDURE 36

Experimental Population
The Subject Matter
The Films
Method of Instruction

IV. THE DATA AND THEIR TREATMENT 43

Mental Ability Test Results
Silhouette Test Results
Factual Knowledge Test Results
All-answers-correct Test Results

Chapter Page

V. CONCLUSIONS 66

Silhouettes
Factual Knowledge
All-answers-correct Test
Hypotheses
Implications

APPENDIXES 75

BIBLIOGRAPHY 125

BIOGRAPHICAL SKETCH 129

LIST OF TABLES

Table Page

1. Comparison of A. C. E. Psychological Examination Mean Scores of Two Chemistry Sections 44

2. Comparison of Mean Ages in Months for Students in the Two Chemistry Sections 45

3. Comparison of E and C Groups' Total Topic-Related Responses to All the Silhouettes for the "Atomic Energy" Topic 48

4. Comparison of E and C Groups' Total Topic-Related Responses to All the Silhouettes for the "Organic Chemistry and Petroleum" Topic 49

5. Comparison of E and C Groups' Per Cent of Topic-Related Responses to Relevant and Irrelevant Silhouettes for "Atomic Energy" Topic 50

6. Comparison of E and C Groups' Per Cent of Topic-Related Responses to Relevant and Irrelevant Silhouettes for "Organic Chemistry and Petroleum" Topic. 51

7. Comparison of Categories for the Silhouette Responses: Per Cent of Responses Related to Categories for the "Atomic Energy" Topic 53

8. Comparison of Categories for the Silhouette Responses: Per Cent of Responses Related to Categories for the "Organic Chemistry and Petroleum" Topic 54

9. "Atomic Energy" Topic Responses for Silhouettes Arranged in Ten Categories: E Group's Responses Minus C Group's Responses for Each Category 55

10. "Organic Chemistry and Petroleum" Topic Responses for Silhouettes Arranged in Ten Categories: E Group's Responses Minus C Group's Responses for Each Category 56

Table Page

11. Gains in Individual Students' Scores for E and C Groups on Factual Knowledge Tests for "Atomic Energy" Topic 57

12. Gains in Individual Students' Scores for E and C Groups of Factual Knowledge Tests for "Organic Chemistry and Petroleum" Topic 58

13. Comparison of E and C Groups' Mean Scores for the Factual Knowledge Test for the "Atomic Energy" Topic . 60

14. Comparison of E and C Groups' Mean Scores for the Factual Knowledge Test for the "Organic Chemistry and Petroleum" Topic 61

15. Internal Comparison of E and C Groups for All-Answers-Correct Test: Mean Gains of "Likeness" for Posttest Minus Pretest Scores for Individuals: Scoring Method I 62

16. Cross Comparison of E and C Groups for All-Answers-Correct Test: Mean Gains of "Likeness" for Posttest Minus Pretest Scores for Individuals: Scoring Method I 64

17. Internal Comparison of E and C Groups for All-Answers-Correct Test: Mean Gains of "Likeness" for Posttest Minus Pretest Scores for Individuals: Scoring Method II 65

18. Cross Comparison of E and C Groups for All-Answers-Correct Test: Mean Gains of "Likeness" for Posttest Minus Pretest Scores for Individuals: Scoring Method II 65

CHAPTER I

INTRODUCTION

Some suggestions have been made for accelerating the rate, quality, and effectiveness of learning and communication by the use of audio-visual aids at all levels of instruction. To accomplish this, audio-visual aids and materials, particularly television and motion pictures, are being used. This study is an attempt to find out if a series of related educational films, used as the basis for a common experience, has any effect on the "likeness" of the viewers' perceptions.

Students of semantics, that science dealing with the relations between symbols ("signs") and what they refer to,[1] generally agree that in order for people to communicate effectively they must have some common perceptions about words and objects. Many educators feel that effective communication is a desirable goal for the pupils in their schools. Thus, any effective way of bringing about this "commonality" of perception of words and objects will help increase the rate, quality, and effectiveness of communication.

---

[1] Webster's New Collegiate Dictionary (6th ed., Springfield, Mass.: G. and C. Merriam Co., 1953), definition, p. 768.

The Problem

The problem is to find out if a group of high school chemistry students taught with related educational films will perceive or "see" facts, information, abstractions, relationships, ideas, and answers more alike than will a group of high school chemistry students who are taught the same subject matter without the use of educational films.

Need for This Study

This study is an attempt to fill part of a gap between educators' understanding of perception and the application of audio-visual instructional techniques.

> Little of the work on perception being done by psychologists, artists, lighting scientists, and the like has found its way into the journals serving the audio-visual field. There is a great gap between known information on perception and its application in instruction through audio-visual techniques.[1]

Another need for this study is indicated by situations with which leaders are faced in educational systems. These are: (1) shortage of teachers, (2) shortage of classrooms, (3) increasing numbers of students, and (4) the demands of society that people learn more, learn faster, and remember longer. Almost all segments of society today recognize that these situations exist, and interpret them as problems to be solved. Many solutions have been proposed, but many of these solutions are either concerned with doing things as they were done years ago when conditions were entirely different or they are concerned with spending less money, per se. Some of these solutions do not take into consideration that there is much more information and knowledge to be learned today than there was when Americans' ancestors established the type of school and university systems which now exists. This seems to be true whether one is concerned with the depths of a narrow specialty or with the vastness of all knowledge.

---

[1] Edgar Dale, James D. Finn, and Charles F. Hoban, Jr., "Audio-Visual Materials," Encyclopedia of Educational Research, ed. Walter S. Monroe (New York: Macmillan Co., rev. ed., 1952), p. 84.

This idea of "commonality" of perception has been aptly expressed by several authors like Brubacher and Kelley.

> If world order is ever to arise from the ashes of current nationalistic rivalries, any permanence it may have must root in the ability of men to think alike to a greater degree[1] than has been their wont to date . . . to undergird world order with enduring peace will require more than an international police force, important as that may be. It will require emotional attitudes of peace incorporated into the habit patterns of boys and girls, men and women, the world over. Of course many agencies like the church, labor unions, movies, radio, and the press can help build these habits, but the major portion of this undertaking must fall to the schools.[2]

Earl Kelley has expressed the same idea from a perceptual point of view.

> Our perceptions do not come simply from the objects around us, but from our past experience as functioning, purposive organisms. We take a large number of clues, none of which is reliable, add them together, and make what we can of them. All that this gives us is an estimate of our surroundings. It is never exactly right.

---

[1] (underlining added).

[2] John S. Brubacher, Modern Philosophies of Education (2nd ed. rev., New York: McGraw-Hill Book Co., 1950), p. 326.

> It is never the same for different individuals. It is like a statistical average, a useful device for making a prognosis, but always wrong in any particular instance.
>
> Since the perception is the usable reality, and since no two organisms can make the same use of clues or bring the same experiential background to bear, no two of us can see alike. We have no common world. Each has his own, to which he responds in his own way. Because our forecasts usually approximate correctness, we make the mistake of assuming they are perfect, and that we do have a common world.[1]

Kelley also remarks on the necessity of more effective communication.

> In order to be effective social beings, we have to approach the other person's point of view. This can be done through better and better communication. We have our mutual language when we are among our own people, and it helps greatly. But when it comes to establishing communion with strange peoples, which we grievously need in our small physical world, the difficulties are enormous.[2]

Most of the research shows that properly used instructional films and other audio-visual aids will do an efficient job of instruction, yet it is hard to understand why more teachers do not make more use of films, television, and radio as well as other audio-visual aids and materials. The data of this study may encourage teachers to use more films and other aids in their teaching.

Some teachers may feel that if all of their students were at a similar level of maturity, mental ability, and understanding, they could teach better; also, some teachers may feel that if all students in a given course could understand a particular idea, or bit of information at about the same time during the course of instruction, more effective learning would result in a shorter period of time.

---

[1] Earl C. Kelley, Education for What is Real (New York: Harper and Brothers Publishers, 1947), p. 34.

[2] Ibid., p. 55.

Will educational films provide for students a "commonality" of perception; that is, will they provide for students an "alikeness of perception" in regard to facts, information, abstractions, answers, and relationships? If films will do this it may be possible for teachers to teach more information or material in less time without sacrificing quality.

Background and Survey of Related Studies

Perceptual psychology is concerned with the way people learn and behave. Perception itself has been described by several authors, one of the best definitions having been made by Smith:

> Perception means, etymologically, to grasp thoroughly (percipere). To grasp thoroughly on the perceptual level signifies to react in all possible ways, by sight, touch, etc. This fact is well expressed in the pedagogical dictum, "multiple sense appeal." Perception is not merely the visual, auditory or other image of an object present to the senses; it involves cognition or the consciousness of a number of facts associated with the object perceived. These facts are derived from past experience with the object, or with related objects![1]

There seem to be two points of view or schools of thought concerning perception and its relationship to behavior, learning, and intelligence. Arthur W. Combs expresses one point of view in the following statement:

> From a perceptual viewpoint, if intelligence is the capacity for effective behavior, the intelligence of an

---

[1] Samuel Smith (ed.), "Educational Psychology," College Outline Series (New York: Barnes and Noble, Inc., 1956), p. 66.

> individual will be dependent upon the richness and variety of perceptions possible to him at a given moment.[1]

In a different writing Combs goes on to say that the way a person learns and behaves is determined by his perceptions and in turn these perceptions are affected in part by the following six variables:

> 1. Perception is a function of the state of the physical organism in which the perception occurs. Perception both affects and is affected by the physical organism which serves as the vehicle for perceiving.
>
> 2. Perception takes time. Effective perception requires sufficient exposure to make perceiving possible.
>
> 3. Perception cannot occur without opportunity for experience. This opportunity for perceiving may be of a concrete character or may be purely symbolic. In any event, there must be some form of opportunity provided for perceiving to happen.
>
> These first three variables of perception are already well known and understood. They have been more or less intensively studied for a number of years. The last three have been far less subjected to experimental study but continue to grow in importance every day. They are:
>
> 4. Perception is a function of the individual's values and goals. The values and goals of the individual have a selective effect upon the individual's field of perceptions. Other factors being equal, people perceive more sharply and effectively those aspects of themselves and of life which have greatest value to them.
>
> 5. Perception is a function of the self concept of the perceiver. The concept of self has a selective effect on the perceptual field. People perceive that which is appropriate for persons with their concepts of self to perceive.

---

[1] Arthur W. Combs, "Intelligence From a Perceptual Point of View," Journal of Abnormal and Social Psychology, XLVII (July, 1952), p. 663.

> Children who perceive themselves as poor readers read poorly. We are only beginning to understand the tremendous importance of the self concept upon every aspect of human behavior. It appears to be the very core around which all the rest of our perceptions of reality are organized.
>
> 6. Perception is seriously affected by the experience of threat. These effects seem to be of two kinds: (a) When a person feels threatened his field of perceptions is reduced to the object of threat producing the well-known tunnel vision;[1] and (b) When threatened, the individual seeks to defend this existing self-organization.[2]

Presumably if all but one of these variables could be held constant for several individuals, this one variable could be studied in an experimental situation. It is doubtful if several individuals would have the same characteristics in relation to all these variables, but a group of people may have characteristics in relation to one or several of these variables. An experimental method has been used so that the common experience of seeing educational films was the experimental variable, while the other variables that affect perception were more or less held constant.[3]

The other point of view or school of thought concerning perception does not accept perception as a cause of the learning process, but rather as an aspect of the learning process. This idea is expressed by Kenneth Norberg:

---

[1] Dr. Combs is referring here to psychological "tunnel-vision" and not the well-known psysiological "tunnel-vision."

[2] Arthur W. Combs, "Intelligence From a Perceptual Point of View," Journal of Abnormal and Social Psychology, XLVII (July, 1952), pp. 663-9, quoted in Arthur W. Combs, "Counseling as a Learning Process," Journal of Counseling Psychology, I (Winter, 1954), pp. 35-6.

[3] See Chapter II for a description of this experimental method which was designed by the author.

> The Hanover Institute demonstrations bear out the thesis that our perceptions are learned. They are results of past experiences and present concerns. . . . It is probably more accurate and more fruitful to think of perception as an aspect or a dimension of the learning process than merely as a "cause."[1]

The reason that the experience factor was selected as the experimental variable is because perceptions, from both points of view, are mainly the results of past experiences and one way or the other perceptions are part of the process of behavior, learning, and intelligence.

The importance of the experience factor in perception is well stated by Earl Kelley:

> . . . we do not get our perceptions from the things around us, but that the perceptions come from us. Since they do not come from the immediate environment (the present), and obviously cannot come from the future, they must come from the past. If they come from the past, they must be based on experience.[2]

No two individuals can have exactly the same experience because of the time and place relationships and the physical law of impenetrability, viz., "That property in virtue of which two portions of matter cannot at the same time occupy the same space."[3]

---

[1] Kenneth Norberg, "Perception Research and Audio-Visual Education," Audio-Visual Communication Review, I (Winter, 1953), pp. 25-6.

[2] Kelley, op. cit., p. 25.

[3] Webster's New Collegiate Dictionary (5th ed., Springfield, Mass.: G. and C. Merriam Co., 1951), definition p. 416.

Even Siamese twins joined at their sides could not always be in exactly the same place at the same time. Their visual perspectives would be slightly different for everything they were observing. Although their perceptions might be somewhat different they would probably be more alike than any other two separate individual's perceptions. Of course there are many other factors in the lives of individuals (including Siamese twins) that affect the way in which they perceive. These include both mental and physical experiences. Theoretically, should several people have the same physical organism, time span, experiences, values and goals, self concepts, and degrees of threat, they would perceive, learn, and behave in much the same way.

One possible way to see whether individuals in a particular group might be led to perceive or "see" more like each other than individuals in a different group, would be to provide the individuals in the first group with common purposes and common experiences. Assuming that the individuals in the second group are having less meaningful or less common experiences, their perceptions will be less alike than are the perceptions of the individuals of the first group. This is neglecting somewhat the idea of self concept, but it does take into consideration the idea of past experiences and present concerns.

For such a study the two groups should be as similar as possible as far as the following factors are concerned:

1. Age.
2. Mental ability.

3. Values and goals.

4. Physical organism differences.

5. Time element.

6. Degree of threat.

Instructional films can provide meaningful, common experiences for a group of students. In turn these experiences should have some effect on the students' perceptions which are both related and unrelated to the films' content.

There are possibly some innate qualities of a projected motion picture which provide this "commonality" of experience. Some of these qualities may be:

1. The sameness of the viewed topic for each individual; although the students may have perceived parts of the information differently, they all viewed the same scenes.

2. The single perspective of the camera and projector lenses. No matter from where in the room the students viewed the projected picture, all the individuals saw visually from the same perspective; namely, from the spot where the camera took the pictures. It would be something like everyone in the room viewing the pictures through the same "knothole."

3. "Tunnel" emphasis on the scene viewed. The room would be darkened and the blinds drawn so that almost everyone's attention would be directed toward the intended scene.

4. The distracting experiences during a film showing as compared with a nonfilm instructional class period are possibly fewer.

5. The "set" or attitude caused by the use of a film in a classroom. This could be either a negative or positive quality.

6. The timing, sequence of events, motion, dramatic events, and special photographic effects built into the films.

The studies located after a detailed survey of research in the field of audio-visual education were organized into the following four categories: (1) studies of a particular audio-visual program, (2) studies of a particular advantage or disadvantage in using audio-visual materials or techniques, (3) studies of the use of audio-visual materials or techniques as related to a particular subject matter area, and (4) basic research in audio-visual education. The studies in category four may be considered as experimental type studies.[1] Only 22 per cent of the studies located were classed in category 4, and were considered of the experimental type. None of these studies showed any direct relation to this study.

John Molstad, in an article published by the Department of Audio-Visual Instruction, organized studies in these categories: (1) administration, (2) audience, (3) media and materials, (4) effect studies, and (5) teacher training.[2] As a part of the summary concerning the amount of research being done in each category Molstad says, "Areas which seem to have been neglected by those doing doctoral dissertations include school plant facilities, audience study, content analysis, and the development of models and theories explaining the communication process."[1] No studies directly related to perceptual psychology were found in this bibliography.

---

[1] Robert E. Krebs, "Survey of Research in Audio-Visual Education" (unpublished bibliography, Library, College of Education, University of Florida, Gainesville, Florida), p. 22.

[2] John Molstad, "Doctoral Dissertations in Audio-Visual Education," Audio-Visual Communication Review, IV (Fall, 1956), pp. 291-333.

There has been some research that may be related to this study even though it does not deal with perception directly. During the twenties, Knowlton and Tilton conducted an experiment using the "Photoplays" (movies depicting historical events) in public school history classes.[2] They found that the course of study was not only enriched, but that pupil's learning of facts increased by 19 per cent, and knowledge of interrelationships between events and forces was increased by 35 per cent. Their study also showed that the film groups remembered 27 per cent more facts after three months than did the nonfilm groups.

In 1928 Wood and Freeman conducted a study using 11,000 children in twelve city schools. Topics of geography and general science were used with and without films. Their conclusions were: (1) in both geography and general science the film groups were superior to the nonfilm groups as to the scores made on the tests, (2) the average "over-all" gain of the film groups was 33 per cent better on the tests, (3) the general science film groups did 15 per cent better on the tests than did the nonfilm groups.[1]

---

[1] *Ibid.*, p. 296.

[2] D. C. Knowlton and J. W. Tilton, *Motion Pictures in History Teaching* (New Haven, Conn.: Yale University Press, 1924), pp. 339-41.

These two studies seem to have set the pace for research in the use of films in teaching. However, several more recent studies do not give the use of films such a favorable picture as to increase and retention of learning. Some of this discrepancy between results of more recent studies and older studies may be explained by the use of recent and more elegant statistical treatments.

In 1950 Abram W. VanderMeer conducted a study involving use of films by three different methods in teaching junior high school general science. These three methods were: (1) films exclusively, each film shown twice, (2) films plus study guides, each film shown twice, and (3) standard lecture methods.[2] His conclusions and implications drawn from this study are as follows:

> The overall results of this study suggest that a body of factual information such as high school general science, may be taught by films alone almost as effectively as by a teacher using conventional classroom methods

---

[1] B. D. Wood and F. N. Freeman, Motion Pictures in the Classroom (Boston, Mass.: Houghton Mifflin Co., 1929), p. 392.

[2] Abram W. VanderMeer, Relative Effectiveness of Instruction by: Films Exclusively, Films Plus Study Guides, and Standard Lecture Methods (Port Washington, L. I., N. Y.: Technical report-SDC269-7-13 of the Special Devices Center, July, 1950), p. 4.

> (except films), and by films introduced and supplemented by brief study guides perhaps a little more effectively than by conventional non-film teaching methods.
>
> It should be borne in mind that the measure of effectiveness adopted in this study has been solely the learning of factual information. It may well be that teachers provide greater motivation, interest, and inspiration, and aid in the development of critical thinking ability through classroom discussions. Furthermore, it seems likely that instruction by teachers plus films, would be more effective than either method alone. On these points this study furnishes no reliable information.
>
> The study clearly suggests that in mass training situations where the task is to impart a specific body of factual information a course of carefully produced films covering this information would result in as effective learning as a course led by instructors using conventional methods. Such a procedure should help considerably to offset a shortage of expert instructors in an emergency situation.[1]

Other studies have been concerned with the attitudes developed by the use of films as well as the factual knowledge gained. During World War II the Armed services used many instructional films as well as other audio-visual devices and materials to speed up the rate of learning. Little research was done to see how effective this instruction was, mainly because personnel were not available to conduct the research. If a device or technique designed for a specific task did not seem to work it was discarded and another tried in its place.[2] Several studies were conducted during the war, however, and later these were compiled by several authors. Two studies of some importance were reported by Hoban and Miles and Spain.

---

[1] Ibid., p. 2.

[2] Dale, Finn, and Hoban, op. cit., p. 85.

C. F. Hoban, Jr., in Movies That Teach, reports on a study by the Research Branch of the Army's Information and Education Division. The Army orientation film, Prelude to War, was shown to a group of inductees in order to determine its effect on their information concerning the events leading to the war, and the consequent morale value of this information.[1] Grade school, high school, and college educated selectees learned something from the film, but those whose educational background included high school or college experience learned more, as measured by percentage of questions answered correctly, than did those whose educational background was limited to grade school.[2] Hoban concluded that the more the audience brings to the motion picture the more the audience gets out of the picture. In reporting this study Hoban also mentions the following:

> . . . But seeing a film does not, as often supposed, appear to make people more alike. The test results from this experiment indicate that a film increases the differences in educational achievement.[3]

This may be true from the point of view of percentage increase of correct answers to factual questions when groups are heterogeneous as to educational background and when only one film is shown. But, is the above statement also true for groups that are homogeneous as to educational background and when several related films are shown?

---

[1] C. F. Hoban, Jr., Movies That Teach (New York: Dryden Press, 1946), pp. 7-9.

[2] Ibid., p. 8.

[3] Ibid., p. 9.

Miles and Spain in Audio-Visual Aids in the Armed Services report on two studies conducted during World War II.[1] Objectives of these studies were to condition men to the requirements of military service and help them develop specific attitudes toward the war and America's allies. To accomplish this the series of orientation films Why We Fight was shown. This series included the films Prelude to War, Divide and Conquer, The Nazis Strike, Battle for Britain, and Battle for Russia. The conclusion to this opinion survey was that: "Men who reported seeing the most Why We Fight films were the most likely to believe that they had a clear idea of why we are fighting this war."[2]

Another study was made of the effects of the film Battle for Britain. This study showed that men who like a film are most influenced by it. Answers favorable toward Britain changed 16 per cent among those liking the film, and only 6 per cent among those not liking the film.[3]

---

[1] J. R. Miles and C. R. Spain, Audio-Visual Aids in the Armed Services (Washington, D. C.: American Council on Education, 1947), pp. 62-3.

[2] Ibid., p. 62.

[3] Ibid., p. 63.

Dale, Finn, and Hoban in the Encyclopedia of Educational Research give the following list of claims, supported by research, for properly used audio-visual materials in teaching:

> 1. They supply a concrete basis for conceptual thinking and hence reduce meaningless word-responses of students.
> 2. They have a high degree of interest for students.
> 3. They supply the necessary basis for developmental learning and hence make learning more permanent.
> 4. They offer a reality of experience which stimulates self-activity on the part of pupils.
> 5. They develop a continuity of thought; this is especially true of motion pictures.
> 6. They contribute to growth of meaning and hence to vocabulary development.
> 7. They provide experiences not easily secured by other materials and contribute to the efficiency, depth, and variety of learning.[1]

Research in the field of audio-visual education indicated that:

1. Realistic objective materials have genuine value in teaching.
2. The effectiveness of audio-visual materials depends on:
   - a. Clarity of purpose for which they are used.
   - b. Age of children.
   - c. Type of children.
   - d. Type of material being studied.
   - e. Character of material used.
   - f. Methods of projection or use.
   - g. Place of use.
   - h. The influence of the teacher who uses the materials.
3. Significant gains have been reported in:
   - a. Informational learning.
   - b. Retention and recall.
   - c. Thinking and reasoning.
   - d. Activity.
   - e. Interest.
   - f. Imagination.

---

[1] Dale, Finn, and Hoban, op. cit., p. 84.

g. Degree of assimilation.
h. Personal growth and expression.
i. Saving in time of (1) preparation of work, (2) completion of minimum essentials.[1]

Studies related to perception, but not necessarily related to audio-visual materials or techniques, have raised some interesting questions.

The medical profession has shown a concern for the way people perceive and the effects of past experiences on their state of health. Simmons and Wolff express this idea:

> . . . The stress occuring from a situation is based in large part on the way the affected subject perceives it. . . . The common denominator of stress disorders is reaction to circumstances of threatening significance to the organism. Such stress reactions are shown to be relevant to disease.[2]

They also point out the relationship of the experience factor with disease:

> . . . Recently [there is] scientific concern for the patient as a goal directed person, whose adjustments and diseases are patterned by his previous experiences and responses.[3]

It would seem that a group of people whose past experiences and perceptions were not only more alike, but also healthy, would be less subject to stress and its resulting diseases. Although it is far beyond the scope of this study there is a need to determine the relationships, if there are any, between a person's experiences, perceptions, stresses, and state of health.

---

[1] Dale, Finn, and Hoban, op. cit., p. 85.

[2] Leo William Simmons and Harold G. Wolff, Social Science and Medicine (New York: Russell Sage Foundation, 1954), p. 25.

[3] Ibid., p. 47.

In the field of advertising the way people "see" the product is extremely important as far as the successful marketing of that product is concerned. In a book aptly named "The Hidden Persuaders" Vance Packard explains how industries and advertisers not only make use of hidden perceptions but actually try to control behavior in favor of certain products by manipulating peoples' experiences and perceptions. This seems to have developed into a new psychology called "depth psychology" and the research related to this psychology is called "motivation research."

> This depth approach to influencing our behavior is being used in many fields and is employing a variety of ingenious techniques. It is being used most extensively to affect our daily acts of consumption. The sale to us of billions of dollars' worth of United States products is being significantly affected, if not revolutionized, by this approach, which is still only barely out of its infancy. Two thirds of America's hundred largest advertisers have geared campaigns to this depth approach by using strategies inspired by what marketers call "motivation analysis."[1]

To explain what motivation research is, Packard quotes Louis Cheskin who is the head of a Chicago research firm that conducts psychoanalytically oriented studies for merchandisers.

> Motivation research is the type of research that seeks to learn what motivates people in making choices. It employs techniques designed to reach the unconscious or subconscious mind because preferences generally are determined by factors of which the individual is not conscious. . . . Actually in the buying situation the

---

[1] Vance Packard, The Hidden Persuaders (New York: David McKay Co., 1957), pp. 3-4.

> consumer generally acts emotionally and compulsively, unconsciously reacting to the images and designs which in the subconscious are associated with the product.[1]

Although there is a great deal of research showing that properly used audio-visual aids and materials are effective in the learning process there is a need to see how these aids affect the perceptions of a group of people. This study, although limited to a series of related films for a particular subject (chemistry), is an attempt to find some answers concerning perception and its relationship to learning.

Following the stated need and related research for this study is a description of the experimental design, Chapter II. Chapter III is the procedure or method used for this study. Chapter IV presents the data and their treatment. Chapter V summarizes the results, while Chapter VI is a series of implications, implementations, and interpretations. Appendixes include all tests and other pertinent materials connected with this study. This is followed by a bibliography of materials used either directly or indirectly in organizing, performing, and reporting this study.

---

[1] *Ibid.*, pp. 7-8.

CHAPTER II

EXPERIMENTAL DESIGN

To find out if educational films have an effect on students' perceptions two comparable classes in high school chemistry participated in this study.[1]

There were two topics studied by both groups. The first topic was "Atomic Energy." The experimental (E) group and the control (C) group were both taught the same content, in the same manner, by the same teacher, with the one exception being the series of films on atomic energy which was shown only to the experimental group. Both classes studied the unit for the same length of time and had equal number of class periods.

In order to eliminate many of the uncontrollable variables, i.e., physical differences, time factors, self concepts, attitudes, home influences, etc., a second topic and series of films were used with the same two classes. For this second topic, "Organic Chemistry and Petroleum," the group which served as the control (nonfilm) group for "Atomic Energy" now became the experimental (film) group. As such they saw films related to "Organic Chemistry and Petroleum."

---

[1] See Chapter III for a more complete account of techniques used to compare these two groups.

At the same time the former experimental (film) group now became the control (nonfilm) group and did not see films. As with the first topic, the content was the same for both groups. The instruction, as far as possible, was the same with the exception of the use of films for the experimental group.

A series of tests was given to each group before the study of each topic, at the end of the study of each topic, and four weeks after the end of the study of each topic. The scores for these three tests were compared for the experimental and control groups to see if the films had any effect on the "likeness" of the answers, responses, and perceptions of the individuals in these groups.[1]

Hypotheses

A series of specific hypotheses were formed to test the basic problem of this study, viz., will a group of students taught a subject with the use of related educational films perceive or "see" facts, information, abstractions, relationships, and answers more alike than will a group of students who are taught the same subject matter without the use of educational films? These hypotheses are:

1. The members of the experimental (film) groups will perceive the specific learning situation more alike than will the

---

[1] See Chapter IV for a more detailed account of the techniques of treating the tests' results.

control (nonfilm) groups.

2. Providing a more common experience (the viewing of related films) will help students to perceive or "see" facts, information, abstractions, relationships, ideas, and answers more in the same way.

3. The experimental groups will show less variance or "spread" in their test scores than will the control groups.

4. The experimental groups will have higher scores (means) for the tests given than will the control groups.

5. The experimental groups will have retained more of the knowledge gained and will "see" silhouettes more alike after a period of four weeks than will the control groups.

Tests and Their Use

The silhouette tests, the all-answer-correct tests, and the matching test were composed by the author. The factual knowledge tests were composed by the authors of the textbook used in this study.[1] The psychological examination used for comparing the groups' mental abilities was composed by the Thurstones.[2]

Each test was given to both sections as pretest (given before the unit of study started), as posttest (given at the finish of the unit), and as retention tests (given four weeks after the finish of the unit). The same tests were used for the pretests, posttests, and retention tests. All of these tests were "dittoed" and any answers students wished to write were placed on the "dittoed" answer sheet provided. If a student was absent from class when any of the tests were given he took a make-up test when he returned to class. In this way, all students had a score for all tests and it was not necessary to eliminate any student from the sample.

---

[1] Charles E. Dull, William O. Brooks, and H. Clark Metcalfe, Modern Chemistry (New York: Henry Holt and Co., Inc., 1954).

[2] L. L. Thurstone and Thelma Gwinn Thurstone, Psychological Examination For High School Students (Washington, D. C.: American Council on Education, 1948).

The first test given in each case was the silhouette test. The reason for this was so students would have no clue (for the pretest) as to what the topic was going to be and thus possibly "color" their responses to certain silhouettes. For the rest of the tests the nature of the topic was self-evident.[1]

Silhouette Tests

The silhouettes were cut from opaque paper and ranged in size from about four to twenty-five square inches. Sixteen silhouettes were used for each topic. Half of these were relevant or meaningful in the sense that they were related to some object, thing, or idea concerned with the topic being studied. The other half of the silhouettes were irrelevant or meaningless abstract cutouts of paper.

The related silhouettes for the "Atomic Energy" topic were: (1) an atomic reactor, (2) a count-rate meter (Geiger counter),

---

[1] See Appendix A for copies of these tests.

(3) an atomic bomb cloud, (4) a model of an atom, (5) a hydrogen bomb cloud, (6) an atomic reactor with heat exchanger and generator, (7) an atomic submarine, and (8) "dees" of a cyclotron (atom smasher).

The related silhouettes for the "Organic Chemistry and Petroleum" topic were: (1) an automobile engine block, (2) liquid petroleum gas storage tanks, (3) a "Christmas tree" valve in a pipe line, (4) a model of a benzene ring, (5) a fractional distillation tower, (6) a model of the molecule of carbon tetrachloride, (7) an automobile piston and connecting rod, and (8) a model of the molecule of iodoform or trichloromethane (chloroform). The other half of the silhouettes, eight for each topic, were not supposed to resemble anything related to the topic being studied.[1] The irrelevant silhouettes were shown to several people not connected with this study. If these people saw something remotely related to the study topic in these irrelevant silhouettes they were discarded and new irrelevant silhouettes were made. In this way any unconscious intent on the author's part to make irrelevant silhouettes that were somehow related to the topic being studied was diminished.[2]

Each silhouette was projected onto a large screen in the front of the room by means of a "Master Vu-Graph" overhead projector.[3] The images of the silhouette projections on the screen varied in size from about one square foot to about nine square feet. This projector was used by the teacher standing in the front of a moderately well-lighted room. The sequence of showing the silhouettes was a mixture of both the relevant and irrelevant, i.e., they were alternated, with the first two being irrelevant. Each silhouette was projected for one minute and the students were instructed to write as many responses as they could think of in that time. After one minute, the next silhouette was projected, and so on until all sixteen were shown for that topic. Each student had a "dittoed" answer sheet which provided spaces for his responses. Before this test was given the students received verbal instructions from the instructor. The students were instructed to write on their answer sheets anything that came to their minds for each silhouette. They were instructed not to limit themselves to one comment but to give as many responses as they could in the one minute each silhouette was projected. They were also asked not to discuss or make verbal comment about the silhouettes. This same procedure was used for the silhouette pretest, posttest, and retention test for both topics and for both groups.

---

[1] See Appendix B for reproductions of the relevant and irrelevant silhouettes; they are arranged in the order they were presented to the students.

[2] All of the silhouettes were cut out before the films were previewed to prevent any unconscious "stacking of the cards."

[3] Master Vu-Graph overhead projector, Charles Beseler Co., 219 South 18th Street, East Orange, N. J.

Factual Knowledge Test

This test was of the multiple choice type and was designed to measure the gain or increase in factual information and the retention of this information. Each question had four possible alternative answers. The students were instructed to choose the answer they thought correct and place that answer on the "dittoed" sheet of questions. The students were also instructed not to guess if they had no idea about the correct answer, but if they had a good hunch about what was correct to answer the question. They were told that one third of the number of wrong answers would be subtracted from the total number of right answers in order to arrive at a score. This test, as a posttest, was also used for grading purposes.

All-answers-correct Test

This test was of the multiple choice type and it was designed to determine whether the experimental group would choose more of the same answers to a specific question than would the control group. Each question had four possible answers from which to choose. Students were told that all the answers were correct, but they were to select the one answer they thought best. They were also instructed to guess if they could not make up their minds which was the best answer in order to give a response for every question. The author tried to pick answers that were equal in "rightness," but this did not seem to be possible in all cases, so the answers that most likely would have been chosen by the students were either placed first or last in the list of possible answers (choices).

The reason for this arrangement was because when a group of individuals are given a choice of selecting a number at random from a series of consecutive numbers they tend to select more of the numbers near the middle of the series. This was demonstrated by the author by asking students from several classes to choose a number from the series of numbers one through five. The students were instructed not to converse with their neighbors and after writing their selection on a slip of paper not to show it to anyone. The results showed that out of 100 students 7 selected No. 1, 15 selected No. 2, 44 selected No. 3, 21 selected No. 4, and 13 selected No. 5. Presumably, if an infinitely large group did this selecting the results would fit a normal curve, with the vast majority selecting the more "middle" numbers.

By placing the right answers which would most likely be selected by the students, either first or last in the series of answers for each question, it was hoped to control this factor of choosing a more "middle" number.

Mental Ability Test

Before the beginning of this study the American Council on Education's Psychological Examination was given to each student in both groups to compare the groups as to their mental abilities.[1] This test was scored by the University of Florida's Board of Examiners in Gainesville, Florida.

Statistical Treatment of Test Results

Several different statistical methods were used in the analysis of data. After consideration of the problem and data a small group technique for treating statistics was used. The t test was used in different forms to make the data gathered for the small groups more understandable. A 5 per cent level of confidence was used for determining any statistically significant difference between the scores of the two groups. A one-tailed test device was used because the hypotheses predicted the direction of the results in favor of the experimental groups.

---

[1] Thurstone and Thurstone, op. cit.

Psychological examination scores.--The scores obtained from the American Council on Education's Psychological Examination were tested for statistically significant differences by the use of the F ratio[1] and the t test.[2]

Projected silhouette responses.--The relevant (meaningful) silhouette responses for each group were compared, as were the irrelevant (meaningless) silhouette responses. The percentages of relevant and irrelevant responses related to the topics studied for the pretest, posttest, and the retention test were compared. Percentages for each category and for each group were tested for statistical significance by using the z test.[3]

The per cent of responses of each group that were related to the topic being studied was compared with responses that were not related to the topics being studied. The actual number of responses related to the topics was used in this case. Statistical significance of the differences between the variances was tested by the F ratio[1] while the significance of the differences between the means was tested by the t test.[2]

---

[1] Helen M. Walker and Joseph Lev, Statistical Inference (New York: Henry Holt and Co., 1954), p. 140 and p. 205.

[2] E. F. Lindquist, First Course in Statistics (New York: Houghton Mifflin and Co., 1942), p. 138.

[3] Walker and Lev, op. cit., p. 78.

Silhouette responses were placed in ten categories and the percentages of responses in each category were compared for the E and C groups. The statistical significance of the differences between percentages was tested by the use of the z test.[3] Chi square was also used to see if there was any statistically significant difference when the responses were placed in categories.[4]

Factual knowledge test responses.--Each question had only one correct response and was intended to test grasp of factual information. This test was composed by the authors of the text used during this study. The multiple choice test for the "Atomic Energy" topic had thirty questions while the test for the "Organic Chemistry and Petroleum" topic had thirty-nine questions. A frequency distribution was made from the scores of each group and from the gains or losses in the scores of the posttest minus the pretest for each individual.

---

[1] Ibid., p. 140 and p. 205.

[2] Ibid., p. 157.

[3] Ibid., p. 78.

[4] Ibid., p. 81.

Variance or "spread" of scores for each group was compared to see if either group had "clustered" scores. The F ratio was used to test the differences in variance for statistical significance.[1]

Mean scores of each class were compared to see which group made the highest average gain in factual knowledge. Mean scores of the increases or decreases (posttest scores minus pretest scores and posttest scores minus retention test scores) were compared to see which group had the greatest amount of gain and retention in factual information. The t test was used to determine if the differences between the means of the gains were statistically significant.[2]

All-answers-correct test.--Each question had four responses, and all of the responses were considered correct. Students were instructed to make a choice according to the answer they thought best or else to guess. There were ten questions of this type for each study topic. Results were compared to see which group, experimental or control, selected more of the same responses after the study of the topic.

Each students' response for each question was compared with all the students' responses for that particular question. Question No. 1 had four possible answers, and each student's choice was compared for likeness with all the students' choices for question

---

[1] Ibid., p. 140.

[2] Ibid., p. 157.

No. 1. This was repeated for each student and for each question. Differences between a student's pretest "like" score and his posttest "like" score gave each individual student a score which represented his increase or decrease in "likeness."

For Method I of treating these results this "likeness" score was determined by the total number of students in each group that selected that particular response (choice). For example, if ten students selected the first response, five selected the second response, four students selected the third response, and no students selected the fourth response, then those students who selected the first response would get ten points for Item 1, those students who selected the second response would get five points for Item 1, and so on. Thus each student in each group had a score that was not only weighted but also showed the degree of "likeness" when compared with the other students. The difference between a student's pretest "like" score and his posttest "like" score gave that individual student a score which represented his increase or decrease in "likeness," in other words his gain. The differences in the means of these gains of "likeness" for E and C groups for each topic were tested for statistical significance by the t test.[1]

These results were also treated in another way. For Method II of treating these results a value of zero, two, four, or six was given to each persons' response for each test item according to which of the four answers had the least to the most student responses, or according to the least to the most number of students selecting that particular answer or choice. If any two responses for a particular item had the same number of students selecting it then an odd number, one, three, or five was used for both of the tie responses, depending on its position. Thus as in the previous method of scoring each student in each group had a score that was not only weighted but also represented the degree of "likeness" when compared with all the students' responses or selections. Differences between the means of the gains were again tested for statistical significance by the t test.[1]

---

[1] Quinn McNemar, Psychological Statistics (2d ed.; New York: John Wiley and Sons, 1955), pp. 85-6.

Limitations

Factors that may have affected the results and conclusions of this study are:

1. The films themselves, i.e., quality, content, length, etc.

2. Any unmeasurable difference in the nature of the two topics.

3. The different time of the school day and year when the topics were studied.

4. Any unnoticed or unintentional emphasis given one group or topic by the teacher.

5. The smallness of the groups.

---

[1] Ibid.

6. The practice effect the experimental group (Section 3) had for the first topic.

7. The assumption that these groups are a representative sample of a normal population.

These are some factors that may not have been controlled by the technique of using a second topic and having the experimental and control groups reversed for this second topic.

This study was not intended to find or give all of the answers that might be asked in this area of perceptual psychology and education. It is hoped that other complementary studies will follow so that the basic premise of this study may be investigated further.

The idea of using films to cause likeness of perceptions is being used as a propaganda and indoctrination technique. Just how effective it is on a large scale when the audience is not "captive" remains to be tested. What would the results of this study be if large groups, groups of mixed ages, groups of different races, groups free to "take or leave" it, or groups with other common experiences and purposes were used? Is it because the audience "projects" itself into the situation presented in the films? What is it that makes viewing the films such a "common" common experience? How can films be made to increase this "commonality?" What are some of the possible dangers involved in getting people to perceive relevant as well as irrelevant things and situations more in the same way? What are some of the advantages and disadvantages? What are the relationships and ratios (if there are any) among the physical organism, experience, purpose, need, self concept, and threat? These are questions that need to be answered if more understanding of this subject is to be forthcoming.

CHAPTER III

PROCEDURE

Two chemistry classes of the P. K. Yonge Laboratory School of the College of Education, University of Florida, Gainesville, Florida, were involved in this study. These chemistry classes were composed mainly of eleventh grade students, although both sections included a few students from the twelfth grade. There were no repeat students in either section.

Experimental Population

Section 3, which met during the third period, had twenty-seven students while Section 6, which met the sixth period, had fifteen students. With regard to sex Section 3 was composed of 29.6 per cent girls while Section 6 was composed of 46.6 per cent girls. The ages of the students ranged from sixteen to eighteen and one half years. The mean age in months for Section 3 was 201.37 months while for Section 6 the mean age was 201.80 months. By the use of the t test it was found that there was no statistically significant difference in the mean ages of the two groups.[1]

---

[1] Lindquist, op. cit., p. 138.

The mean score for the American Council on Education's Psychological Examination for Section 3 was 84.4 while for Section 6 the mean score was 90.6. By the use of the t test it was found that there was no statistically significant difference in the mean American Council on Education's Psychological Examination scores of the two groups.[1]

Section 3 met at 10:30 A. M. for fifty-five minutes, five days per week; while Section 6 met at 2:10 P. M. for fifty-five minutes, five days per week. All students involved had one year of biology during their tenth year in school. Both sections had already studied basic chemistry during the first semester of the year that this study was conducted.

After a discussion with the students about what topics might be studied during the second semester and what the general operational procedure of this study would involve, both groups were unanimous in their desire to participate in this study. The instructor was careful, at all times, not to disclose the real purpose of the study or what the tests were designed to measure. To see if the students did or did not understand the purpose of this study the students were instructed to write on a card what they thought the purpose of this study was and to write any comments about the study that they wished to make.[2]

---

[1] Ibid.

[2] See Appendix C for copies of these statements.

The Subject Matter

The two topics selected for this study were "Atomic Energy" and "Organic Chemistry and Petroleum." These were selected from several possible topics or units of study for the following reasons: (1) instructional films were available that fit each topic, (2) these topics were part of the regular second semester's work, (3) reference materials and some laboratory equipment suitable to these topics were available, (4) the basic text Modern Chemistry included chapters relative to these topics.[1] Each section had twenty-four consecutive fifty-five minute class periods for each of the two topics.

The Films

The following sixteen-millimeter sound films were used for the experimental (film) group for the topic "Atomic Energy." Group 3 saw each of these eight films while Group 6 did not see them.

1. Atomic Energy, EBF, BW, 11'
2. Inside The Atom, Nat'l. Film Bd. of Canada, BW, 11'
3. Atomic Radiation, EBF, BW, 12'
4. The Atom and Biological Science, EBF, BW, 12'
5. Carbon Fourteen, EBF, BW, 12'
6. A Is for Atom, Gen. Elec. Corp., C, 16'
7. Atom Smashers, EBF, BW, 11'
8. The Atom Goes to Sea, Gen. Elec. Corp., BW, 10'

---

[1] Dull, Brooks, and Metcalfe, op. cit.

The sixteen-millimeter films following were used for the experimental (film) group for the topic "Organic Chemistry and Petroleum." Group 6 saw each of these eight films while Group 3 did not see them.

1. Crude Oil Distillation, Shell Oil Co., BW, 11'
2. Oil for Aladdin's Lamp, Shell Oil Co., BW, 18'
3. Refining Oil for Energy, Shell Oil Co., BW, 18'
4. Birth of an Oil Field, Shell Oil Co., C, 18'
5. Prospecting for Petroleum, Shell Oil Co., C, 18'
6. Patterns for Chemicals, Shell Oil Co., BW, 18'
7. Evolution of the Oil Industry, Bu. of Mines, C., 18'
8. Gasoline for Everyone, Ethyl Corp., BW, 10'

These films were selected on the basis of their appropriateness. After ordering the films which seemed best likely to fit the topics, they were previewed, and for each film a detailed outline of its subject matter was made. The following criteria were used to determine the final selection and use of the films:

1. Appropriateness to content of topic being studied.
2. Technical quality.
3. Appropriateness to grade level.
4. Accuracy of information presented.
5. Organization of information presented.

Eight films were used for each topic. These films were used to the best of the ability of the instructor in a manner he felt was the most efficient and effective. This method is explained in detail in the section following.

Method of Instruction

Both chemistry sections were assigned the same basic text material, the same classroom, and given access to the same reference materials as well as the same laboratory equipment. At the beginning of each unit for each section there was an introductory lecture by the instructor. As the groups became more familiar with the content of the topics, more resource materials were utilized. At this point the instructor performed several demonstrations to illustrate some principles in order to familiarize the students with particular pieces of apparatus. Students were then asked to choose a "project," special demonstration, or special report that was related to the topic being studied. During the remainder of the unit the students worked about two periods per week on their laboratory "projects." The other three or four periods per week were devoted to lectures, discussions, reviews, and tests.

At all times the instructor tried to teach both sections in the same way with, of course, the exception of the films. When a film was shown to the experimental section, the detailed outline of that film's content was used as the basis for a lecture, discussion, or demonstration with the control group. Although only the experimental section saw the film, both groups had the same content for that particular lesson. The only variable recognized was that of the film. The subject matter, visual aids such as chalkboards, diagrams, and textbook pictures, time emphasis, and enthusiasm were kept as constant as possible.

The instructor showed the films and explained the important parts of the films to the experimental groups. After a film was shown, a follow-up discussion was held. If any points of information were not clear, they were explained in detail. If the students did not understand a film and wished to see it a second time it was reshown. For this second showing important aspects of the film were reëmphasized.[1] This procedure for using educational or instructional films in a classroom is accepted as desirable by most of the authorities in the field of audio-visual education.

The technique of exchanging the groups for the second topic was expected to eliminate many uncontrollable variables. It must be kept in mind that for the second topic the control group already had the experimental experience once; therefore any differences were not expected to be as great as they were for the first topic. For the "Atomic Energy" topic, Group 3 was the experimental or film group while Group 6 was the control group. For the second topic, "Organic Chemistry and Petroleum," Group 3 became the control or nonfilm group while Group 6 became the experimental or film group.

---

[1] If the students understood the film after the first showing they expressed a desire not to sit through a second showing.

An attempt was made to keep the classes as close together, as far as length of presentation was concerned, as possible. This was not always possible due to school activities and other uncontrollable interruptions. A day-to-day account of the activities of both classes for both topics can be found in Appendix D. For an outline of some of the subject matter for both topics, other than the content presented in the films, see Appendix E. Students used these outlines along with films, textbooks, and other reference materials.

The procedures used were: (1) reversed groups for the second topic, (2) each group studied same content on about the same day, (3) one teacher for both groups, (4) both groups spent about same amount of time on topics, (5) the students did not know purposes of the study and tests, (6) the variable was that the experimental groups saw the films while the control groups studied the content of the films in lecture-discussion periods. These procedures were expected to provide an adequate experimental situation. Even though the groups were small and limited to studying two topics these procedures made it possible to collect usable data, which is presented in Chapter IV following.

CHAPTER IV

THE DATA AND THEIR TREATMENT

It may be said that the results for some of the tests were not consistent with the hypotheses. However, there did seem to be a trend when the results of the different tests were viewed as a total picture for both groups.

The experimental (film) groups did not gain more, statistically, in factual knowledge nor did they, statistically, retain more facts. The experimental groups showed a definite statistical advantage in giving "like" responses when the results for the irrelevant (meaningless) silhouettes were compared; but the experimental groups showed little, if any, advantage in giving "like" responses when the results of the relevant (meaningful) silhouettes were compared. For the all-answer-correct test there was an indication that the experimental groups did choose more of the same answers, although this was more evident for one of the topics than for the other.

Mental Ability Test Results

The American Council on Education's Psychological Examination was used to find if the two groups were comparable in their mental ability. There was no statistically significant difference in the variances of scores for this test, or in the means of the two groups' scores for this test.

There was no statistically significant difference in the variances or the means of the ages of the two groups. The F ratio[1] was used to test the significance of variance while the t test[2] was used to test the significance of the difference between the mean scores of the two groups. Table 1 shows the comparison of the mental ability scores for the two groups while Table 2 compares their ages.

TABLE 1

COMPARISON OF A. C. E. PSYCHOLOGICAL EXAMINATION MEAN SCORES OF TWO CHEMISTRY SECTIONS

	S. D.	Variance (S^2)	Mean
Section 3	13.63	185.87	42.41
Section 6	11.90	141.61	45.33
Difference	1.73	44.26	2.92
F		1.312	
t			0.681
Significance		none	none

---

[1] Walker and Lev, op. cit., p. 140 and p. 205.

[2] Lindquist, op. cit., p. 138.

TABLE 2

COMPARISON OF MEAN AGES IN MONTHS FOR STUDENTS IN THE TWO CHEMISTRY SECTIONS

	S. D.	Variance (S^2)	Mean
Section 3	7.01	50.39	201.37
Section 6	5.92	35.31	201.80
Difference	1.09	15.08	0.43
F		1.43	
t			0.195
Significance		none	none

Silhouette Test Results

All responses to the silhouettes for both sections were tallied according to whether or not they were related to the topic being studied. The responses given by each student for each silhouette that was related to the particular topic being studied were compared. For each student the number of related responses for the pretest was subtracted from the number of related responses for his posttest. The mean gain in related responses was determined for the experimental and control groups. These mean gains were tested for statistical significance by the t test.[1] Likewise the number of student topic-related responses on the retention test were subtracted from their responses on the posttest. The mean losses were determined for both groups and tested for statistical significance.

---

[1] Walker and Lev, *op. cit.*, p. 157.

For the "Atomic Energy" topic the gain of the experimental group over the control group in the mean scores of the related responses for the silhouette posttest minus pretest was 1.04. This was not a statistically significant difference. The difference between the mean scores of the experimental and control groups (Table 3) for the silhouette posttest minus retention test related responses was 0.03, which was not statistically significant.

For the "Organic Chemistry and Petroleum" topic the difference between the mean scores of the experimental and control groups for the silhouette posttest minus pretest related responses was 0.58, which was not statistically significant. The difference between the mean scores of the experimental and control groups (Table 4) for the silhouette posttest minus retention test was 0.30, which was not statistically significant.

There was no statistically significant difference between the means, and there did not seem to be any trend when the total topic-related silhouette responses for both groups were compared. As will be shown later this was not true when the topic-related responses were separated for the relevant and the irrelevant silhouettes.[1]

---

[1] See Tables 5 and 6 and their descriptions for a more detailed explanation.

The variance of all topic-related silhouette responses for the "Atomic Energy" topic were compared for significance by the use of the F ratio. For the posttest minus the pretest the F equaled 3.607 which was statistically significant at the 1 per cent level of confidence. For the posttest minus the retention test (Table 3) the F equaled 1.814 which was not statistically significant.

For the "Organic Chemistry and Petroleum" topic the F for all the topic-related responses for the posttest minus pretest was 2.363 which was statistically significant at the 5 per cent level of confidence. The F for the posttest minus the retention test (Table 4) was 2.614 which also was significant at the 5 per cent level of confidence.

Although the experimental groups had a smaller variance for their topic-related responses for the "Organic Chemistry and Petroleum" topic this was not true for the "Atomic Energy" topic. When the variance for both the relevant and irrelevant silhouette results are considered together neither the experimental nor control groups show a statistical advantage.

All responses from both the relevant and irrelevant silhouettes that were related to the topic being studied were separated and tallied.

TABLE 3

COMPARISON OF E AND C GROUPS' TOTAL TOPIC-RELATED RESPONSES TO ALL THE SILHOUETTES FOR THE "ATOMIC ENERGY" TOPIC

	Posttest Scores Minus Pretest Scores		Posttest Scores Minus Retention Test Scores	
	E Sec. 3	C Sec. 6	E Sec. 3	C Sec. 6
Mean (gains)	5.37	4.33	-0.30	-0.33
Difference	1.04		0.03	
t	1.211		0.049	
Significance	none		none	
s^2	13.115	3.357	4.906	2.714
F	3.607		1.814	
Significance	0.01		none	

For both topics the experimental groups gave a statistically significant higher per cent of topic-related responses to both the relevant and irrelevant silhouettes. The level of confidence for the "Atomic Energy" topic was greater for the irrelevant silhouettes (.0005) than for the relevant silhouettes (.05).

For both topics the experimental groups gave a statistically significant higher per cent of topic-related responses for the relevant silhouettes. For both topics (Tables 5 and 6) the level of confidence was .0005.

TABLE 4

COMPARISON OF E AND C GROUPS' TOTAL TOPIC-RELATED RESPONSES TO ALL THE SILHOUETTES FOR THE "ORGANIC CHEMISTRY AND PETROLEUM" TOPIC

	Posttest Scores Minus Pretest Scores		Posttest Scores Minus Retention Test Scores	
	E Sec. 6	C Sec. 3	E Sec. 6	C Sec. 3
Mean (gains)	2.87	2.29	-0.40	-0.70
Difference	0.58		0.30	
t	0.644		0.455	
Significance	none		none	
s^2	5.285	12.500	2.614	6.946
F	2.363		2.614	
Significance	0.05		0.05	

TABLE 5

COMPARISON OF E AND C GROUPS' PER CENT OF TOPIC-RELATED RESPONSES TO RELEVANT AND IRRELEVANT SILHOUETTES FOR "ATOMIC ENERGY" TOPIC

	Responses to Relevant (Meaningful) Silhouettes			Responses to Irrelevant (Meaningless) Silhouettes		
	E Sec. 3		C Sec. 6	E Sec. 3		C Sec. 6
Pretest	13.6%		13.0%	1.6%		0.0%
Difference		0.6%			1.6%	
z		0.272			1.821	
Significance		none			0.05	
Posttest	47.9%		46.4%	13.4%		3.9%
Difference		1.5%			9.5%	
z		1.582			3.434	
Significance		0.05			0.0005	
Retention test	46.2%		40.7%	7.2%		3.3%
Difference		5.5%			3.9%	
z		3.689			1.751	
Significance		0.0005			0.05	

TABLE 6

COMPARISON OF E AND C GROUPS' PER CENT OF TOPIC-RELATED RESPONSES TO RELEVANT AND IRRELEVANT SILHOUETTES FOR "ORGANIC CHEMISTRY AND PETROLEUM" TOPIC

	Responses to Relevant (Meaningful) Silhouettes			Responses to Irrelevant (Meaningless) Silhouettes		
	E Sec. 6		C Sec. 3	E Sec. 6		C Sec. 3
Pretest	42.40%		40.20%	1.01%		1.86%
Difference		2.2%			0.85%	
z		1.154			0.768	
Significance		none			none	
Posttest	70.7%		63.7%	5.4%		1.8%
Difference		7.0%			3.6%	
z		2.717			1.997	
Significance		0.005			0.025	
Retention test	69.00%		54.60%	3.25%		0.33%
Difference		14.40%			2.92%	
z		7.437			2.624	
Significance		0.0005			0.005	

All responses to the silhouettes were placed into ten categories according to their relationship to the subject of the individual categories. The following ten categories were used: (1) human, (2) parts of humans, (3) animals, (4) parts of animals, (5) objects of nature, (6) man-made objects, (7) buildings, (8) machinery, (9) land forms and geography, and (10) original or fictional.

The decision to use these categories was made after reading some studies concerning the Rorschach Ink Blot tests.[1] Some of the categories used in the Rorschach Ink Blot test, with revisions, seemed applicable to both relevant and irrelevant type silhouettes.

For the "Atomic Energy" topic Section 3 (E) had a significant increase of 10.93 per cent of responses from the pretest to the posttest for the eighth category (machinery). This is compared to an increase (Table 7) of only 6.64 per cent of responses in this category for Section 6 (C).

For the "Organic Chemistry and Petroleum" topic Section 6 (E) had a significant increase of 10.60 per cent of responses from the pretest to the posttest for the fifth category (objects of nature). This is compared to an increase (Table 8) of only 6.60 per cent of responses in this category for Section 3 (C).

---

[1] Samuel J. Beck, Rorschach's Test; I Basic Processes (New York: Grune and Stratton, 1949); Bruno Klopfer, et al, Developments in the Rorschach Technique, Part I (Yonkers-on-Hudson, New York: World Book Co., 1954); Alfred A. Knopf, Projective Psychology (New York: Alfred A. Knopf, 1950).

TABLE 7

COMPARISON OF CATEGORIES FOR THE SILHOUETTE RESPONSES: PER CENT OF RESPONSES RELATED TO CATEGORIES FOR THE "ATOMIC ENERGY" TOPIC

	Experimental, Section 3			Control, Section 6		
Categories	Pretest	Posttest	Retention	Pretest	Posttest	Retention
1.	5.60%	5.53%	6.92%	5.48%	7.22%	4.73%
2.	6.96	5.34	4.93	5.19	3.06	4.18
3.	10.53	7.37	7.08	9.56	6.11	8.36
4.	2.04	1.51	1.69	1.87	1.39	2.34
5.	19.86	18.95	17.84	18.29	15.56	14.21
6.	20.37	19.43	19.23	26.19	29.16	23.35
7.	6.60	4.86	4.31	5.41	3.60	5.82
8.	21.90	32.83	31.08	21.41	28.05	28.13
9.	3.22	2.18	2.92	1.66	2.22	2.23
10.	2.89	3.35	4.00	4.98	3.61	5.57

For both topics there was no significant increase or decrease in the per cent of responses for any category between the posttest and the retention test.

TABLE 8

COMPARISON OF CATEGORIES FOR THE SILHOUETTE RESPONSES: PER CENT OF RESPONSES RELATED TO CATEGORIES FOR THE "ORGANIC CHEMISTRY AND PETROLEUM" TOPIC

	Experimental, Section 6			Control, Section 3		
Categories	Pretest	Posttest	Retention	Pretest	Posttest	Retention
1.	6.55%	4.32%	6.07%	3.88%	3.75%	4.18%
2.	0.97	0.62	1.59	2.29	1.46	1.17
3.	9.98	8.64	8.95	9.72	10.02	10.20
4.	4.13	3.39	2.34	5.47	5.01	4.52
5.	12.86	23.46	21.09	13.43	19.83	19.39
6.	26.21	24.39	22.36	22.61	20.46	22.91
7.	3.39	3.39	6.07	5.30	4.38	5.18
8.	31.31	27.46	28.43	32.70	32.57	29.93
9.	0.49	0.00	0.00	0.88	0.21	0.33
10.	5.09	4.32	3.19	3.71	2.29	2.17

This would seem to indicate that the experimental group who saw the "Atomic Energy" films gave more responses that had some relationship to "machinery" (Category 8) than did the control group who did not see the films. It would also seem to indicate that the experimental group who saw the "Organic Chemistry and Petroleum" films gave more responses related to "objects of nature" (Category 5) than did the control group who did not see the films.

Another way of comparing the increases and decreases of the silhouette responses for the categories was by the use of Chi square. For each category the control groups' responses were subtracted from the experimental groups' responses. These differences for each category were compared for statistical significance by the use of Chi square. The results show (Tables 9 and 10) that for the total differences of all categories of the "Atomic Energy" topic responses there was a statistically significant difference for the pretest, posttest, and retention test; while for the "Organic Chemistry and Petroleum" topic responses there was a statistically significant difference for only the posttest responses.

TABLE 9

"ATOMIC ENERGY" TOPIC RESPONSES FOR SILHOUETTES ARRANGED IN TEN CATEGORIES: E GROUP'S RESPONSES MINUS C GROUP'S RESPONSES FOR EACH CATEGORY

	Pretest (E - C) (Sec. 3 - Sec. 6)	Posttest (E - C) (Sec. 3 - Sec. 6)	Retention Test (E - C) (Sec. 3 - Sec. 6)
Chi Square	21.915	18.282	18.958
Significance	0.01	0.03	0.025

TABLE 10

"ORGANIC CHEMISTRY AND PETROLEUM" TOPIC RESPONSES
FOR SILHOUETTES ARRANGED IN TEN CATEGORIES:
E GROUP'S RESPONSES MINUS C GROUP'S
RESPONSES FOR EACH CATEGORY

	Pretest (E - C) (Sec. 6 - Sec. 3)	Posttest (E - C) (Sec. 6 - Sec. 3)	Retention Test (E - C) (Sec. 6 - Sec. 3)
Chi Square	15.189	17.744	10.121
Significance	none	0.04	none

This would seem to indicate that when all the responses to the silhouettes for all the categories are compared there is little difference between the experimental and control groups except for the posttest responses. This would mean that the experimental groups did give a statistically significantly higher number of silhouette related responses after the study of both topics.

This method of using Chi square did not disclose for which of these categories the experimental groups had a significantly higher number of responses. The previous method of comparing the gains in per cents does point out the significant categories for each topic.

Factual Knowledge Test Results

As mentioned previously, this test was designed to measure the increase or gain in factual knowledge or information.

For the "Atomic Energy" topic (Tables 11 and 12) the difference between the means for the gains of individual student scores (posttest minus pretest) for the factual knowledge test was .11, which was not statistically significant. The difference between the mean gains for individuals of the posttest minus retention test was 1.39, which was not statistically significant.

TABLE 11

GAINS IN INDIVIDUAL STUDENTS' SCORES FOR E AND C GROUPS ON FACTUAL KNOWLEDGE TEST FOR "ATOMIC ENERGY" TOPIC

	Posttest Scores Minus Pretest Scores			Posttest Scores Minus Retention Test Scores		
	E Sec. 3		C Sec. 6	E Sec. 3		C Sec. 6
Mean	13.04		12.93	-3.52		-2.13
Difference		0.11			1.39	
t		0.071			0.922	
Significance		none			none	
Variance S^2	15.19		35.64	12.41		28.36
F		2.34			2.85	
Significance		0.05			0.01	

TABLE 12

GAINS IN INDIVIDUAL STUDENTS' SCORES FOR E AND C GROUPS OF FACTUAL KNOWLEDGE TESTS FOR "ORGANIC CHEMISTRY AND PETROLEUM" TOPIC

	Posttest Scores Minus Pretest Scores			Posttest Scores Minus Retention Test Scores		
	E Sec. 6		C Sec. 3	E Sec. 6		C Sec. 3
Mean	13.07		10.30	-3.73		-3.48
Difference		2.77			0.25	
t		1.611			0.153	
Significance		0.05			none	
Variance (S^2)	26.79		32.39	35.93		7.20
F		1.21			4.99	
Significance		none			0.01	

The experimental group (Tables 11 and 12) for the "Atomic Energy" topic had a statistically significantly smaller variance or "spread" in its scores than did the control group ($F = 2.34$), but this was not so for the experimental group in the "Organic Chemistry and Petroleum" topic ($F = 1.21$).

For the "Organic Chemistry and Petroleum" topic (Table 12) the difference between the means for the gains of individual student scores was 2.77 for the posttest minus pretest. This difference was significant at the 5 per cent level of confidence. The difference between the mean gains for individuals of the posttest minus retention test was .25 which was not statistically significant.

For both topics in only one of the four cases (Table 12) was the difference between the means of the individual gains statistically significant in favor of the experimental groups. This case was the posttest minus pretest for the factual knowledge test of the "Organic Chemistry and Petroleum" topic.

For both topics in three of the four cases the variance (S^2) of scores for the experimental groups was less than the variance of scores for the control groups. This case (Table 12) was the posttest minus pretest scores for the factual knowledge test of the "Organic Chemistry and Petroleum" topic.

When the variances and means of the individual gains for the two groups for both topics were compared there was little consistency. In other words, when considered statistically, the over-all picture shows (Tables 11 and 12) that neither the film nor the nonfilm groups had an advantage or learned more factual knowledge related to the topic being studied. This applies as well to the retention of the factual knowledge related to the topics.

Another way to look at the results for the factual knowledge tests is to consider the means directly of one group as compared to the other group. For example, this was done for the American Council on Education's Psychological Examination scores. If the reader recalls, Section 3 had a mean score of 84.22 which Section 6 had a mean score of 90.27 and the difference between these means was 6.05, while the _t_ for this difference was .682, which was not statistically significant. Therefore, it was concluded that there was no statistically significant difference between the mental abilities of the two groups. This same simple testing of differences of means between the two groups was done for each mean score for the factual knowledge test.

For the "Atomic Energy" topic (Table 13) the difference between the mean scores of Section 3 (E) and Section 6 (C) was .27 for the pretests, .37 for the posttests, and 1.01 for the retention tests. In none of these cases were these differences statistically significant.

TABLE 13

COMPARISON OF E AND C GROUPS' MEAN SCORES FOR THE FACTUAL KNOWLEDGE TEST FOR THE "ATOMIC ENERGY" TOPIC

	Pretest		Posttest		Retention Test	
	E Sec. 3	C Sec. 6	E Sec. 3	C Sec. 6	E Sec. 3	C Sec. 6
Mean	6.74	6.47	19.77	19.40	16.26	17.27
Difference	0.27		0.37		1.01	
_t_	0.184		0.150		0.650	
Significance	none		none		none	

For the "Organic Chemistry and Petroleum" topic (Table 14) the difference between the mean scores of Section 6 (E) and Section 3 (C) was .30 for the pretests, 2.66 for the posttests, and 1.66 for the retention tests. There was no statistical significance to these differences.

TABLE 14

COMPARISON OF E AND C GROUPS' MEAN SCORES FOR THE FACTUAL KNOWLEDGE TESTS FOR THE "ORGANIC CHEMISTRY AND PETROLEUM" TOPIC

	Pretest		Posttest		Retention Test	
	E Sec. 6	C Sec. 3	E Sec. 6	C Sec. 3	E Sec. 6	C Sec. 3
Mean	7.33	7.63	20.73	18.07	16.47	14.81
Difference	0.30		2.66		1.66	
t	0.184		0.996		0.999	
Significance	none		none		none	

All-answers-correct Test Results

This test was designed to see which group would choose more of the same answers when all the answers given for each question were considered correct. Each answer selected by each student was compared with the answers selected by all the students. The t test was used for the significance of the difference between the means of the gains.

An internal comparison was made first. This was done to see if the means of the gains (posttest minus pretest scores) were statistically significantly different from zero. For scoring Method I of the "Atomic Energy" topic the mean gain of "likeness" from zero (posttest minus pretest) for Section 3 (E) was 17.22. This difference (Table 15) was significant from zero at the .05 per cent level of confidence. The mean gain from zero for Section 6 (C) was 3.00 which was not statistically significant from zero.

TABLE 15

INTERNAL COMPARISON OF E AND C GROUPS FOR ALL-ANSWERS-CORRECT TEST: MEAN GAINS OF "LIKENESS" FOR POSTTEST MINUS PRETEST SCORES FOR INDIVIDUALS: SCORING METHOD I*

	"Atomic Energy" Topic Posttest - Pretest		"Organic Chem." Topic Posttest - Pretest	
	E Sec. 3	C Sec. 6	E Sec. 6	C Sec. 3
Means (gains)	17.22	3.00	12.07	30.85
t (from zero)	3.677	1.156	2.891	4.225
Significance	0.0005	none	0.005	0.0005

For the "Organic Chemistry and Petroleum" topic the mean gain of "likeness" from zero for the posttest minus pretest for Section 6 (E) was 12.07 which was statistically significant at the .5 per cent level of confidence. The mean gain from zero (Table 15) for the posttest minus pretest for Section 3 (C) was 30.85 which was statistically significant at the .05 per cent level of confidence.

---

*See Chapter II for a description of Scoring Method I.

This would seem to indicate that when these mean scores for the all-answer-correct test are compared, the experimental groups for both topics have a higher mean gain in selecting the same answers.

A cross comparison was made to see if there was any statistically significant difference between the means of the two groups.

For scoring Method I of the "Atomic Energy" topic the mean gain of "likeness" (posttest minus pretest) for Section 3 (E) was 17.22 and for Section 6 (C) it was 3.00. The difference (Table 16) between these means was 14.22 which was statistically significant at the 5 per cent level of confidence.

For scoring Method I of the "Organic Chemistry and Petroleum" topic the mean gain of "likeness" (posttest minus pretest) for Section 6 (E) was 12.07 and for Section 3 (C) the mean gain was 30.85. The difference between these means was 18.78 which was statistically significant at the .05 per cent level of confidence.

TABLE 16

CROSS COMPARISON OF E AND C GROUPS FOR ALL-ANSWERS-CORRECT TEST: MEAN GAINS OF "LIKENESS" FOR POSTTEST MINUS PRETEST SCORES FOR INDIVIDUALS: SCORING METHOD I

	"Atomic Energy" Topic Posttest - Pretest		"Organic Chem." Topic Posttest - Pretest	
	E Sec. 3	C Sec. 6	E Sec. 6	C Sec. 3
Means (gains)	17.22	3.00	12.07	30.85
Difference	14.22		18.78	
t	1.786		3.789	
Significance	0.05		0.0005	

In comparing Tables 17 and 18 with Tables 15 and 16 the results for scoring Method II seems to confirm the results of scoring Method I.

The experimental group for the "Atomic Energy" topic (Section 3) had a significantly higher "likeness" score for both methods of scoring, but this was not true for the experimental group (Section 6) for the "Organic Chemistry and Petroleum" topic.

TABLE 17

INTERNAL COMPARISON OF E AND C GROUPS FOR ALL-ANSWERS-CORRECT TEST: MEAN GAINS OF "LIKENESS" FOR POSTTEST MINUS PRETEST SCORES FOR INDIVIDUALS: SCORING METHOD II[*]

	"Atomic Energy" Topic Posttest - Pretest		"Organic Chem." Topic Posttest - Pretest	
	E Sec. 3	C Sec. 6	E Sec. 6	C Sec. 3
Means (gains)	4.147	0.933	3.200	7.148
t (from zero)	2.675	0.483	2.105	4.132
Significance	0.005	none	0.025	0.0005

TABLE 18

CROSS COMPARISON OF E AND C GROUPS FOR ALL-ANSWERS-CORRECT TEST: MEAN GAINS OF "LIKENESS" FOR POSTTEST MINUS PRETEST SCORES FOR INDIVIDUALS: SCORING METHOD II

	"Atomic Energy" Topic Posttest - Pretest		"Organic Chem." Topic Posttest - Pretest	
	E Sec. 3	C Sec. 6	E Sec. 6	C Sec. 3
Means (gains)	4.147	0.933	3.200	7.148
Difference	3.214		3.948	
t	1.298		1.713	
Significance	none		0.05	

---

[*] See Chapter II for a description of Scoring Method II.

CHAPTER V

CONCLUSIONS

Changing perceptions and effecting a similarity of perceptions for a large diverse group of individuals would be extremely difficult if not impossible. This difficulty arises because of the many variables which affect perceptions and in particular because of the many varied experiences any large group of individuals will have during their time and place on this earth. When a more homogeneous group such as used for this study is considered, the possibility of changing and causing a similarity of perceptions seems feasible.

Silhouettes

When groups have the common experience of viewing a series of related films they tend to give similar responses to these silhouettes. Films seem to produce a "likeness" of perceptions in a group of individuals. This seems to be particularly true for perceptions of irrelevant and meaningless silhouettes. From this information the author concludes that a series of films as used in a situation similar to this study will make a group of people perceive some things more alike, i.e., abstractions, ideas, information, and answers to questions. Viewing these films will also increase some of the types of responses for particular categories, e.g., man-made objects and objects of nature. The type of responses will change when these categories have some relationship to the films' content or topic, e.g., man-made objects for the "Organic Chemistry and Petroleum" topic and machinery for the "Atomic Energy" topic. The author further concludes from these results that a common experience will make a homogeneous group of people perceive irrelevant abstractions more alike.

Factual Knowledge

From the results of this study the findings bear out the conclusion that a series of related films as used in this study do partially affect the "spread" of the scores for the factual knowledge test, but that these films do not significantly affect the means of these scores for the experimental and control groups. This conclusion seems to be in harmony with some of the recent research in the field of audio-visual education. A well-taught class should learn about as much factual knowledge whether or not films are used, but the test scores for the film groups will be more "bunched" than will be the test scores for the nonfilm groups.

From the results of this study it may be concluded that films do not increase the amount of or the retention of factual knowledge as much as some early studies indicated, but in some cases they do lessen the "spread" of factual knowledge test scores for a group who sees the films.

All-answers-correct Test

From the results of this unique test it may be concluded that a common experience, such as viewing related films, does make a group of people perceive specifics more alike, in particular to select more of the same specific responses to a specific question. Those who have a common experience other than viewing related films seem to have a longer retention of their specific selection of the responses. The control groups, who gained little in "likeness" of response and hence were changed little in this respect, retained their "likeness" of response better than did the experimental groups. Perhaps this was due to the fact that the extent of the film experiences for this study were not sufficient to permanently overcome all of their past lifetime experiences.

The all-answers-correct test and silhouette test developed for use in this study are sufficiently unique that they may be useful in further similar studies.

Hypotheses

Although the data and results of the tests are not completely consistent there is enough evidence to make some statements concerning the stated hypotheses.

1. The members of the experimental (film) groups will perceive the specific learning situation more alike than will the control (nonfilm) groups.

There is an indication that the experimental groups did perceive specific learning situations more alike. This seems to be particularly true when it is considered that Section 3 already had an experimental practice experience as the film group for the "Atomic Energy" topic when they became the control group (nonfilm) for the second topic.

2. Providing a more common experience, the viewing of related films, will make students perceive facts, information, abstractions, relationships, ideas, and answers more in the same way.

There seems to be a trend for the experimental groups to "see" more alike. This is especially true when giving topic-related responses to irrelevant silhouettes. This would seem to indicate that films will make some groups perceive abstractions, relationships, and ideas more alike than they will facts, information, and answers.

3. The experimental groups will show less variance or "spread" in their test scores than will the control groups.

This was true for only the silhouette test scores of the "Organic Chemistry and Petroleum" topic and for the factual knowledge test scores of the "Atomic Energy" topic. Therefore, there is not conclusive evidence that related films will reduce the "spread" of scores for a viewing group with the possible exception of the scores in a factual-knowledge type test.

4. The experimental groups will have higher scores (means) for the tests given than will the control groups.

Again, a categorical answer can not be given because of the inconsistency of the test results. The experimental groups did not have a consistently higher mean score for both topics except for the topic-related responses for the irrelevant silhouettes. There were several cases where the experimental group had a higher mean score for some of the tests. When the groups were switched for the second topic the results become inconsistent.[1]

5. The experimental groups will have retained more of the knowledge gained and will "see" silhouettes more alike after a period of four weeks than will the control groups.

There is no evidence that the experimental groups retained more factual knowledge after four weeks than did the control groups. The experimental groups for both topics did give, after four weeks, a significantly higher per cent of topic-related responses to both relevant and irrelevant silhouettes than did the control groups. So it may be concluded that no more factual knowledge was retained by the film groups, but perceiving silhouettes more in the same way was retained.

---

[1] Some of this inconsistency may be explained by the fact that Section 3 was the experimental group for the first topic and the control group for the second topic, thus a practice effect was introduced.

Implications

Based on the research of this study and the research of related studies reviewed the implications below are suggested.

In teaching.--Teachers of specific subjects, at all levels, may find it advantageous to use related films to help students have a more common experience, thus enabling the students to perceive the particulars of the subject more in the same way. This in turn may facilitate the increase in the rate and the quality of learning and communication. In some classes this might be considered desirable but in others undesirable. In any class for effective communication students and also teachers must have some common perceptions. This idea of establishing common perceptions may also influence the judgments, values, and attitudes of classes. There is concern to teach moral and spiritual values in the classroom, not necessarily as a subject, but as a goal, a philosophy of life, or something worthwhile for the students. From the research quoted in this study and from the results of this study the author suggests that teaching of abstract moral and spiritual values could be accomplished by helping students perceive things more in the same way. In this case the moral and spiritual values acceptable to the community or society would be the goal of common perceiving.

In government.--In governments where a great deal of conformity is essential, a series of common experiences and purposes could be employed. Films are now being used for this purpose. Propaganda films are used by many of the major powers today. These films are not only used to get their own people to "see" things more in the same way, i.e., the way required by the government, but also to influence people from other countries.

If the people of the world are to live in harmony and avoid devastating wars they must have some common experiences in order to perceive things more in the same way so that they can communicate and live more effectively.

In industry and advertising.--The idea of "seeing" alike by providing common purposes and experiences for many people is used by industries and advertisers. By providing standardized products, by creating common desires for their products, by standardized and repetitive advertisement, by use of factors of prestige and obsolescence, and by applying motivation research and depth psychology industries and advertisers are making use of the idea of people perceiving more or less alike after having a common experience. This common experience is usually implemented by the use of one or more vehicles of mass communication. It appears that industries and advertisers will attempt more and more in the future to provide common purposes and experiences for the great mass of people so they will perceive things more alike, in this case more in the way that would create a desire and demand for the industries' products and the advertisers' services.

In health and medicine.--In some of the more recent research in the area of perception related to health there is some evidence that how a person perceives his situation may well determine not only his state of health but also his susceptibility to diseases.

If there is foundation for this idea then it would surely be to everyone's benefit to perceive or "see" his situation in his environment in such a light that he could maintain a high degree of health. This may or may not be obtained by individuals perceiving more alike.

Fini.--A very broad interpretation of these results might be: If you want people to perceive, think, and act more alike, provide them with common experiences and purposes; if you want people to perceive, think, and act less alike, provide them with different experiences and purposes.

The results and conclusions made in this study could be used either constructively or destructively depending on the philosophy and purposes of the user. It is not the purpose of this study to make value judgments as to the use of these results.

APPENDIX A

Tests Used in This Study

Multiple Choice

Name__________________ #___ Sec.____ Date____________________

Score______

Directions: Write on the line at the left of each statement the number preceding the word or expression that best completes the statement. Questions 1-10 refer to Fig. 1.

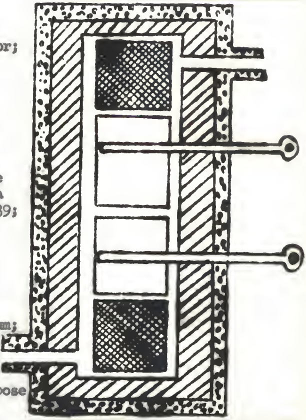


Fig. 1

___ 1. This type of nuclear device is known as a (1) cyclotron; (2) reactor; (3) electroscope; (4) Geiger counter.

___ 2. The material which is placed in this device and then withdrawn after suitable changes have occurred is (1) a mixture of U-235 and U-238; (2) a mixture of U-234 and U-239; (3) natural neptunium; (4) natural radium.

___ 3. The material which protects the working personnel is (1) iron; (2) concrete; (3) aluminum; (4) uranium.

___ 4. The substance which is present for the main purpose of slowing down fast neutrons is (1) concrete; (2) graphite; (3) water; (4) aluminum.

___ 5. The heat produced is removed largely by circulating (1) oil; (2) liquid air; (3) alcohol; (4) water.

___ 6. The element in the control rods which can slow down or stop the device, when the control rods are lowered, is (1) cadmium; (2) krypton; (3) barium; (4) carbon.

____ 7. The material charged into this device is generally encased in cans made of (1) iron; (2) magnesium; (3) sodium; (4) aluminum.

____ 8. The fissionable material produced in this device is (1) plutonium; (2) uranium -235; (3) tritium; (4) barium.

____ 9. The purpose of the control rods is to (1) slow down electrons; (2) speed up protons; (3) absorb gamma radiations; (4) absorb neutrons.

____10. The purpose of the moderator is to (1) slow down protons; (2) absorb electrons; (3) absorb all radiations; (4) adjust neutron speed.

____11. The rays which indicated natural radioactivity were discovered by (1) Einstein; (2) Mme. Curie; (3) Becquerel; (4) Roentgen.

____12. The alpha rays given off by radium are really (1) electrons; (2) deuterons; (3) helium nuclei; (4) X-rays.

____13. The Curies not only discovered radium but also another radioactive element named (1) uranium; (2) polonium; (3) germanium; (4) francium.

____14. Gamma rays are very similar to (1) electrons; (2) X-rays; (3) alpha rays; (4) deuterons.

____15. A gaseous element given off during the natural disintegration of radium is (1) oxygen; (2) krypton; (3) hydrogen; (4) radon.

____16. By bombarding nitrogen with alpha rays, Rutherford succeeded in producing the element (1) carbon; (2) oxygen; (3) fluorine; (4) argon.

____17. The equation which indicates the fundamental relation between matter and energy was formulated by (1) Dalton; (2) the Curies; (3) Einstein; (4) Cockroft and Walton.

____18. Natural uranium contains about .7% of (1) U-234; (2) U-235; (3) U-238; (4) U-239.

____19. In 1932, the most effective atomic "bullet" was discovered. This bullet is (1) the deuteron; (2) the proton; (3) the electron; (4) the neutron.

____20. The principal nuclear process which occurs when U-238 is bombarded with slow neutrons is (1) fission; (2) fusion; (3) neutron capture; (4) a chain reaction.

____21. The principal material produced when lithium ($_3$Li) is bombarded with high speed protons is (1) neutrons; (2) boron; (3) helium; (4) oxygen.

____22. A man-made element produced by Seaborg during atomic bomb research is (1) curium; (2) radium; (3) francium; (4) astatine.

____23. The main purpose of a type of atomic pile known as a "breeder" is to (1) produce more uranium; (2) produce a chain reaction; (3) breed large quantities of heat energy; (4) produce more plutonium than the U-235 used.

____24. The element whose compounds are used in the gaseous diffusion process for seperating uranium isotopes is (1) hydrogen; (2) oxygen; (3) fluorine; (4) helium.

____25. The energy liberated in the sun is produced by nuclear fusion of (1) hydrogen; (2) oxygen; (3) carbon dioxide; (4) helium.

____26. The process of nuclear fusion requires (1) many fast neutrons; (2) many slow neutrons; (3) very high temperature; (4) very high critical size.

____27. A chain reaction is possible in an A-bomb because of the production of (1) barium; (2) krypton; (3) neutrons; (4) beta rays.

____28. When unstable U-239 disintegrates naturally, it produces (1) neptunium; (2) uranium -238; (3) tritium; (4) many neutrons.

____29. When the material which initiates the reaction is also one of the products, the reaction is (1) impossible; (2) a chain reaction; (3) an irreversible reaction; (4) endothermic.

____30. Persons suffering from thyroid disorders are treated with compounds containing radioactive (1) fluorine; (2) barium; (3) calcium; (4) iodine.

Organic Chemistry

Name________________________________ Sec.____ Date____________

Directions: Write in the space at the left of each statement the number preceding the word or expression that best completes the statement. Questions 1-5 refer to Fig. 13.

( ) 1. The liquid in the dropping funnel should be (1) water; (2) hydrochloric acid; (3) sodium hydroxide; (4) alcohol.

( ) 2. The flame being produced by the burning gas is (1) colorless; (2) a smoky, dark yellow; (3) a bright white; (4) a dark blue.

( ) 3. The purest sample of the gas being produced could be collected by (1) displacement of water; (2) displacement of air with delivery tube held downward; (3) displacement of air with delivery tube held upward; (4) displacement of air with delivery tube held sideways.

( ) 4. The compound produced inside the generator is (1) $CaCO_3$; (2) CaC_2; (3) CaO; (4) $Ca(OH)_2$.

( ) 5. This generator could be replaced by one of the generator set-ups used for producing (1) methane; (2) ammonia; (3) sulfur dioxide; (4) bromine.

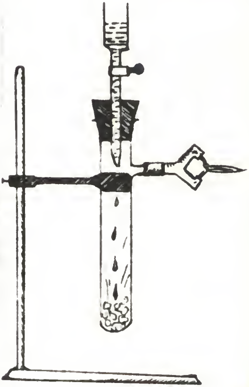


Fig. 13

( ) 6. One reason for the great number of organic compounds is (1) the abundance of carbon; (2) the great activity of carbon at ordinary temperatures; (3) the existence of isomers; (4) carbon's variable valence.

( ) 7. The ability of carbon atoms to form chains by combining with each other is also demonstrated by atoms of the element (1) sulfur; (2) sodium; (3) silicon; (4) alcohol.

( ) 8. Members of the methane series occur in greatest number in (1) coal tar; (2) natural gas; (3) petroleum; (4) alcohol.

( ) 9. Organic compounds are different from inorganic compounds because (1) most organic compounds dissolve readily in water; (2) organic compounds are not easily decomposed by heat; (3) organic compounds are formed by reactions proceeding very rapidly; (4) most organic compounds do not dissociate.

( ) 10. Hexane has the formula (1) C_2H_6; (2) C_3H_6; (3) C_6H_{14}; (4) C_6H_6.

( ) 11. A member of a hydrocarbon family has the formula C_9H_{20}. The next member of this homologous series would have the formula (1) $C_{10}H_{21}$; (2) $C_{10}H_{22}$; (3) $C_{10}H_{24}$; (4) $C_{10}H_{40}$.

( ) 12. The addition compound formed when ethylene reacts with bromine has the formula (1) CBr_4; (2) C_2Br_6; (3) $C_2H_4Br_2$; (4) CH_4Br_2.

( ) 13. The substance which is known as "marsh gas" is (1) H_2S; (2) CH_4; (3) CO_2; (4) C_2H_2.

( ) 14. The substance used to ripen fruits is (1) methane; (2) ethylene; (3) acetylene; (4) benzene.

( ) 15. A hydrocarbon obtained from pine trees is (1) naphthalene; (2) benzene; (3) turpentine; (4) asphalt.

( ) 16. Compounds which have the same number and kind of atoms but a different arrangement of the atoms in the molecule are called (1) isotopes; (2) allotropes; (3) isomers; (4) polymers.

( ) 17. Bottled gas contains (1) methane; (2) propane; (3) heptane; (4) benzene.

( ) 18. Heating a mixture of sodium acetate with sodium hydroxide produces (1) a fat; (2) an ester; (3) methane; (4) acetic acid.

( ) 19. A hydrocarbon material which is not a mixture is (1) naphthalene; (2) kerosene; (3) benzene; (4) paraffin wax.

( ) 20. When one molecule of acetic acid dissociates, the number of ions produced is (1) 0; (2) 2; (3) 3; (4) 8.

( ) 21. Monochlormethane is another name for (1) methyl chloride; (2) chloroform; (3) iodoform; (4) carbon tetrachloride.

( ) 22. A substance commonly used in fire extinguishers is (1) methanol; (2) ethyl chloride; (3) iodoform; (4) carbon tetrachloride.

( ) 23. A common type of denatured alcohol contains 5% of (1) methanol; (2) ethanol; (3) isopropanol; (4) glycerol.

( ) 24. Fermentation of glucose sugar by yeast results in the production of (1) wood alcohol; (2) grain alcohol; (3) glycerine; (4) isopropyl alcohol.

( ) 25. Glycerin is a trihydroxy alcohol related to the hydrocarbon (1) methane; (2) ethane; (3) propane; (4) butane.

( ) 26. A substance with the formula, C_2H_5COOH is (1) an alcohol; (2) an aldehyde; (3) an acid; (4) an ester.

( ) 27. Heating ethanol and sulfuric acid at 140° C. produces (1) acetic acid; (2) ether; (3) formaldahyde; (4) acetaldehyde.

( ) 28. Acetic acid is a by-product of the destructive distillation of (1) wood; (2) soft coal; (3) coal tar; (4) petroleum.

( ) 29. The organic compound formed by the reaction between an alcohol and an inorganic acid is (1) a salt; (2) a fat; (3) an ester; (4) an aldehyde.

( ) 30. A poisonous organic acid is (1) citric acid; (2) oxalic acid; (3) tartaric acid; (4) lactic acid.

( ) 31. Methyl salicylate is the name of (1) an ester; (2) a fat; (3) an acid; (4) an alcohol.

( ) 32. A solution of ethyl alcohol (1) turns red litmus to blue; (2) turns blue litmus to red; (3) bleaches both kinds of litmus; (4) does not affect the color of litmus.

( ) 33. Grape sugar is the common name for (1) levulose; (2) dextrose; (3) sucrose; (4) lactose.

( ) 34. The process of esterification is most similar to (1) saponification; (2) neutralization; (3) hydrogenation; (4) oxidation.

( ) 35. A compound which contains no oxygen is (1) butane; (2) starch; (3) glucose; (4) sucrose.

( ) 36. All fats are (1) soaps; (2) esters; (3) salts; (4) alcohols.

( ) 37. Cane sugar is (1) lactose; (2) dextrose; (3) levulose; (4) sucrose.

( ) 38. The main difference between fractional and destructive distillation is that fractional distillation (1) separates mixtures; (2) decomposes complex hydrocarbons; (3) requires the presence of air; (4) proceeds only in the presence of catalysts.

( ) 39. Catalytic cracking is used mainly in the production of (1) organic acids; (2) carbohydrates; (3) gasoline; (4) benzene.

Multiple Choice

Name_________________________ #_____ Sec._______ Date______________

Directions: Choose only one answer and place its number in the space to the left of the question. (All answers correct, do not leave any question unanswered.)

( ) 1. Radioactive carbon is used in research such as (1) photosynthesis; (2) oxidation of food in animals; (3) organic chemical reactions; (4) assimilation of digested foods.

( ) 2. An atomic reactor or pile produces or gives off (1) neutrons; (2) heat; (3) radiation; (4) plutonium.

( ) 3. A controlled atomic chain reaction may be used to (1) produce radioactive isotopes; (2) generate electricity; (3) drive a ship or submarine; (4) preserve foods.

( ) 4. Radioactive phosphorus is (1) an isotope of phosphorus; (2) used for treatment of brain cancers; (3) used to study translocation in plants; (4) used for research in agricultural fertilizers.

( ) 5. Gamma rays may be used to (1) produce deep X-ray pictures; (2) penetrate substances which beta rays cannot; (3) treat cancers; (4) determine radiation absorption qualities of substances.

( ) 6. The atomic bomb may be used to (1) contaminate air with dangerous radiation; (2) blast and burn cities; (3) destroy plant and animal life; (4) defend against attacking armies.

( ) 7. Nuclear radiations may be used to (1) determine the thickness of metal sheets; (2) detect loosely packed tobacco in cigarettes; (3) tell where different oil starts and stops in a pipeline; (4) change the structure of plastics.

( ) 8. The principle of the half life in radioactive decay may be used to (1) determine the rate of one radioactive element decaying into another; (2) estimate the age of the earth; (3) estimate age of artifacts; (4) tell how much radiation is given off over a period of time.

( ) 9. Radioiodine may be used to (1) trace iodine to the thyroid gland; (2) treat cancer of the thyroid gland; (3) reduce thyroid activity; (4) produce gamma rays for X-rays of the thyroid gland.

( ) 10. A Geiger Counter may be used to (1) detect gamma radiation; (2) detect beta radiation; (3) determine amount of radioactive fallout from atomic bombs; (4) prospect for and detect uranium ore.

Multiple Choice

Name__________________________ #___ Sec.____ Date_______________

Directions: Chose only one answer and place its number in the space to the left of the question. (All answers correct, do not leave any question unanswered.)

( ) 1. A great number of organic compounds are possible for the following reason:
  1. The ability of carbon atoms to join other carbon atoms.
  2. Because the carbon atom has four valence bonds.
  3. Because of the existence of organic isomers.
  4. Because of the great abundance of carbon atoms.

( ) 2. The advantage of a structural formula over a simple formula is:
  1. Easier to read.
  2. Tells how the different atoms are linked together in the molecule.
  3. Depicts more accurately the real structure of organic molecule.
  4. Easier to graphically take apart and build on to.

( ) 3. Acetylene is used for:
  1. Cutting and welding steel.
  2. The fuel of the oxyacetylene torch.
  3. Miners lamps.
  4. The production of benzene and other synthetic organic compounds.

( ) 4. What is the difference between organic and inorganic compounds?
  1. Fewer organic compounds are soluable in water.
  2. Many organic compounds are destroyed by heat.
  3. Organic reactions proceed slower.
  4. Organic compounds do not usually ionize or dissociate.

( ) 5. A characteristic a good gasoline should have is:
  1. Enough volatile matter to make starting easy.
  2. Free of gummy residues.
  3. Good mileage per gallon.
  4. Good anti-knock qualities.

( ) 6. A product obtained from crude oil is:
  1. Gasoline. 3. Fuel oil.
  2. Kerosene. 4. Lubricating oil.

( ) 7. The purpose of a fractionating tower is to:
   1. Separate the more volatile compounds from the less volatile.
   2. Remove the gasoline from the heavier oils.
   3. Separate the heavier products according to their condensing points.
   4. Distill the petroleum so its different factions may be collected separately.

( ) 8. The chemical name for a chlorine substitution product of methane is:
   1. Monochlormethane.
   2. Dichlormethane.
   3. Trichlormethane.
   4. Tetrachlormethane.

( ) 9. Glycerin is used:
   1. For the production of synthetic resins and paints.
   2. As a moistener in tobacco.
   3. As an antifreeze.
   4. As a pharmaceutical ingredient.

( ) 10. How does laundry soap differ from toilet soap?
   1. Has an excess of sodium hydroxide.
   2. Made from cheaper oils and fats.
   3. Has rosin and sodium carbonate added to it.
   4. Contains borax and sodium silicate.

Silhouette Test

Name________________________ #____ Sec._____ Date____________

What do you think of when you see each silhouette? List as many things as you can for each silhouette.

1. ____
____

2. ____
____

3. ____
____

4. ____
____

5. ____
____

6. ____
____

7. ____
____

8. ____
____

9. ____
____

10. ______________________________

____

11. ______________________________

____

12. ______________________________

____

13. ______________________________

____

14. ______________________________

____

15. ______________________________

____

16. ______________________________

____

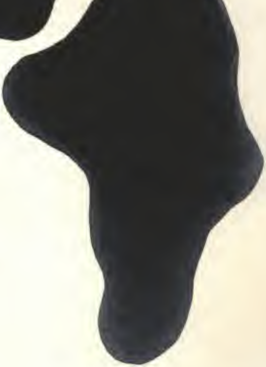
APPENDIX B

Silhouettes Used for the Silhouette Tests

Silhouettes used for "Atomic Energy" topic

#1

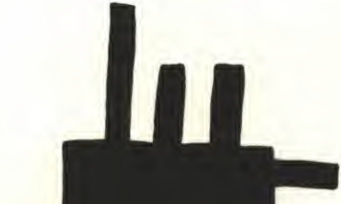
irrelevant



#2

irrelevant

Silhouettes used for "Atomic Energy" topic



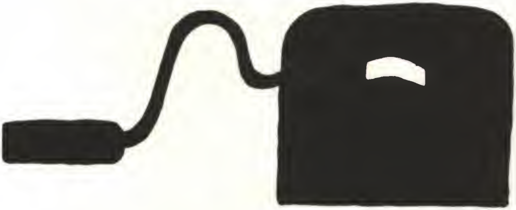
#3

relevant
(atomic pile or reactor)

#4

irrelevant

Silhouettes used for "Atomic Energy" topic



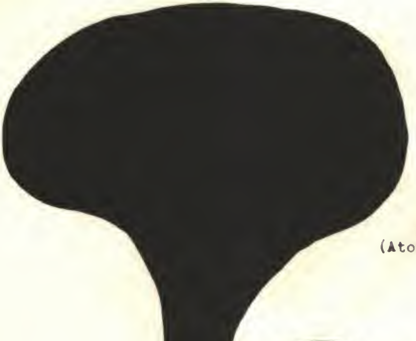
#5

relevant
(count-rate meter)

#6

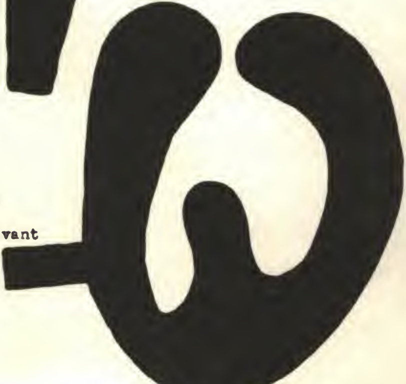
irrelevant

Silhouettes used for "Atomic Energy" topic



#7

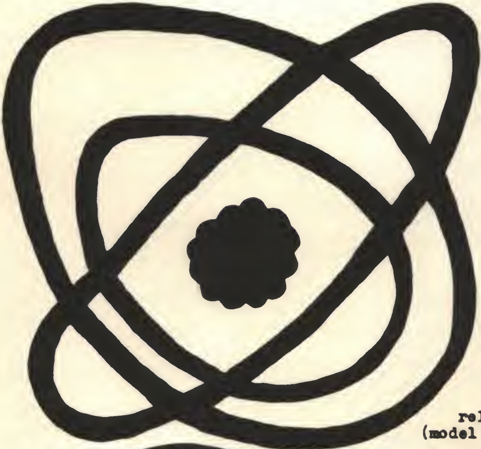
relevant
(Atomic bomb cloud)



#8

irrelevant

Silhouettes used for "Atomic Energy" topic



#9

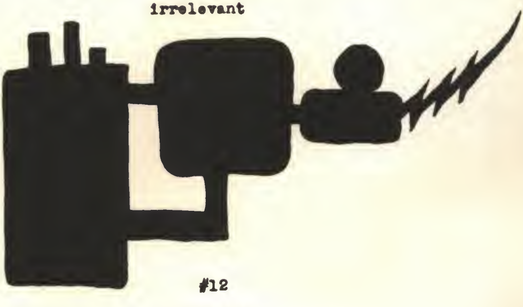
relevant
(model of an atom)

#10 relevant (Hydrogen bomb cloud)

Silhouettes used for "Atomic Energy" topic

#11

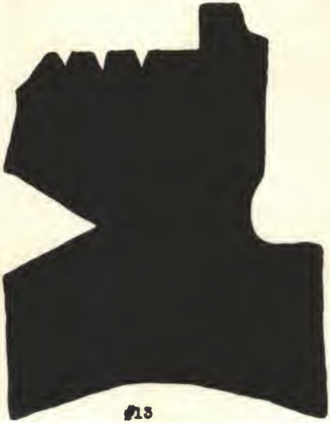
irrelevant



#12

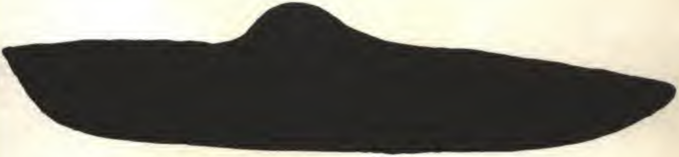
relevant
(atomic reactor and power generator)

Silhouettes used for "Atomic Energy" topic



#13

irrelevant



#14

relevant (atomic submarine)

Silhouettes used for "Atomic Energy" topic

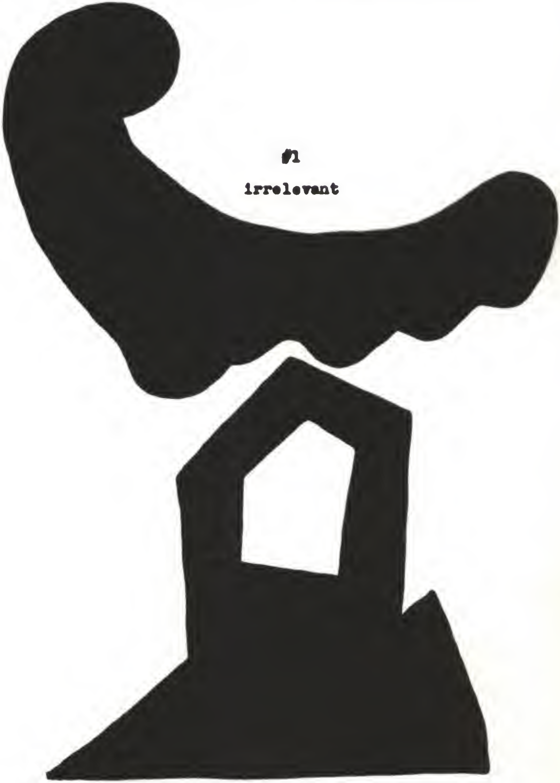
#15

irrelevant

#16

relevant
("Dees" of a Cyclotron)

Silhouettes used for "Organic Chemistry" topic



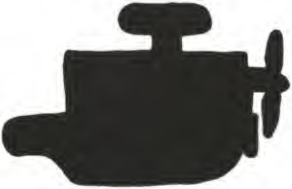
#1

irrelevant

#2

irrelevant

Silhouettes used for "Organic Chemistry" topic



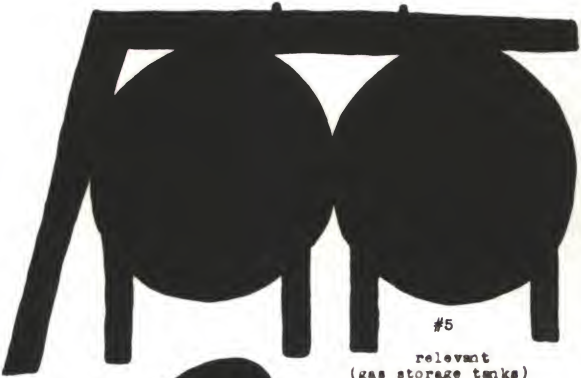
#3

relevant
(automobile engine)

#4

irrelevant

Silhouettes used for "Organic Chemistry" topic



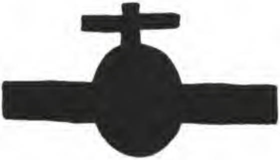
#5

relevant
(gas storage tanks)

#6

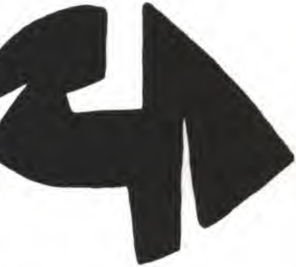
irrelevant

Silhouettes used for "Organic Chemistry" topic



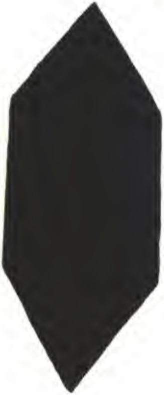
#7

relevant
("Christmas tree" oil
pipe line valve)



#8

irrelevant



#9

relevant
(diagram of benzene ring)

Silhouettes used for "Organic Chemistry" topic

#10

relevant
(fractional distillation
tower)

#11

irrelevant

#12

relevant
(model of carbon tetra-
chloride)

Silhouettes used for "Organic Chemistry" topic

#13 irrelevant

#14

relevant
(automobile engine piston
and rod)

#16

relevant
(model of iodoform or tri-
chloromethane or chloroform)

#15

irrelevant

APPENDIX C

Statements Made by Students at End of Study

Student Comments Following Completion of This Study

I think the first test was just to see your level before the unit, and the second to see what you learned, and the third how long you retained your knowledge. Movies and lectures were to determine the most effective method of teaching. The silhouettes I don't understand at all.

Trying to find out which way of teaching was better, using films or demonstrations. By giving us a series of test you could compare what we knew to begin with, with what we learned and also to see how much we retained, whether the class that had movies or the other class retained the most. (Actually it depends on the subject.) The shadow pictures tested our imagination.

I. Silhouettes--trying to see if we could apply our learning to recognize certain objects. II. Posttest, Pretest, and Post-post test to see how much we knew at the start of a unit, then to see if we learned anything in the unit, and then to see if we remembered what we had learned.

I think that you were trying to compare the two classes, to see which was the most intelligent, and to see which method of teaching was the best.

Trying to see if with movies we could retain the information longer. Perhaps because we could see the information in use rather than just reading and discussing it.

I think you were attempting to find if movies would aid or hinder in learning chemistry. The silhouettes seemed to be a recognition test and also a stability test to see if reactions were serious or not. The all-right test seemed to be a study of our attitudes toward things and our conception of importance. I think you were trying to see if movies gave greater insight.

You were trying to find out how aids help in teaching and does it help at all. The tests were perhaps to tell how well the information is retained and how much students know before and after a unit. The silhouette test I am not sure of, but it could be how a group of people see the same object at the same time. How well do people relate the silhouette.

Prove that you can learn more from seeing a movie than by being told about it. Silhouette--things that were in the movie and chapters.

1. Some of the silhouettes didn't have any meaning and others did. 2. The test showed what we needed to know.

You were trying (I think) to find out which section learned most (with or without movies), and if the section with movies learned more uniformly, that is, seeing movie experiments from the same viewpoint, whether they learned more alike. As for the individual tests--the objective test found out what specific facts we had absorbed. The silhouettes showed whether our interpretation of new or abstract situations had changed by the unit. The test with all-right answers I don't know.

Project for a college class. Find out how much the class progressed in learning chemistry. Silhouettes were to stimulate our minds and to make us think out what we were doing in chemistry.

I think you were trying to find out if we remembered the shape of instruments that we used (silhouettes). I don't remember much about the rest of it.

I think that you was trying to find out, how well we read our chapter, noticed pictures, and how much outside work we did in that unit. That would mean reading other textbooks. The three tests given was to determine the things we knew before we got started, what we learned when we finished the unit and how much more we learned after we have done left the unit for a period of time. You was also experimenting to help find a decent was of teaching students--so that they could learn what they wanted to, and get credit for the amount they do.

I think you were testing to see if movies aided in teaching. If we were influenced by the chapter we had just taken as a unit. How our conceptions of the silhouettes compared. How they changed when we were presented certain factors. How long we maintained what we built up.

Pretest--know the amount we knew about the subject before study began. Pictures--I don't understand why you used the pictures except maybe to see if we could get scientific answers. Regular test--note the amount of improvement made after each study. Movies and Lectures--see what grade could learn the most. Posttest--see how much we could retain after a given amount of time.

I think that you were comparing us in what we did learn and how long we remember it.

Our ability to grasp facts under different conditions. Our ability to retain facts over a period of time. The extent of our knowledge, through absorption in environment, about certain subjects. Power of suggestion with silhouettes.

I think you wanted to see mainly if we got more out of a unit if you used visual aids, than if you just told us what the facts were. To see if we could recognize things we had studied in the silhouettes. In this way you could tell if we remembered what the things we saw looked like.

I think you were trying to find out how well people learn things; how well they remember them; what relationships people see between shapes and objects; and how movies affect classroom procedure and the way students learn.

I think you were trying some psychological thing about how well and how fast we learn. Also, how well we remember. Using the silhouette test, you were probably trying to find out what kind of imagination we had.

I think you have been trying to see if we were paying attention in class and following the book. I reckon if the results were poor, that proves you didn't do a very good job teaching.

Trying to find out how much we knew before we were showed the movies, and before we had a look at the chapter. In the silhouettes I think you were trying to see how big an imagination we had, and how we compared with others.

1. Trying to show that we learn and retain facts better by seeing movies, etc., in connection with the unit we were studying, than by not seeing them.

I think you were trying to determine how much we could learn with a movie, and without pictures. I don't know what the silhouettes were for.

Comparing the reactions on different things between the two classes. To see if movies are more helpful in learning about the subject than oral explanations.

I think you were trying to prove that you can learn faster and more from films than you can from books. The shadow test was to see how many things we picked up from the film that we didn't get from the book or discussion.

I think you were trying to find out if we learned more by teaching with movies or by discussion. The silhouettes were to see how we related them to actual things.

I think you were trying to find out the intelligence, horse sense, and the ability of some people to crack up before others.

You gave us a test before we were acquainted with the material we were tested on. Then you acquainted us with the material. You acquainted each section in a different way. Then you gave the test again to see which section knew the most.

APPENDIX D

Daily Record of Activities for Both Groups

Daily Record For "Atomic Energy" Topic

Date	Experimental Sec. 3 10:30 A.M. daily	Control Sec. 6 2:10 P.M. daily
Tues. Jan. 3	Gave pretests of the silhouette, factual knowledge, and all-answers-correct tests.	Same as for experimental group.
Wed. Jan. 4	Gave matching test as a pretest. Showed film Atomic Energy. Gave an oral introduction to topic for study and assigned Ch. 37 in text.	Gave matching test as a pretest. Lectured on content of film Atomic Energy. Gave an oral introduction to topic for study and assigned Ch. 37 in text.
Thurs. Jan. 5	15 minute class study time for Ch. 37. Introduced and showed Inside the Atom, discussed same.	15 minute class study time for Ch. 37. Discussed content of film, Inside the Atom, from detailed outline of same.
Fri. Jan. 6	Reviewed films and text up to this point, saw film, Atomic Radiation.	Reviewed film content and text up to this point, discussed content of film Atomic Radiation.
Mon. Jan. 9	Discussed student projects and reports, gave out list of possible projects, etc., on atomic energy. Reviewed. Gave demonstration on use of "Classmaster" countrate meter, ionization chamber. Passed out information sheet on "How to operate the "Classmaster."	Same as for experimental group.
Tues. Jan. 10	Selected individual projects and reports. Explained file on atomic information and materials. Gave instructions on how to gather information for projects.	Selected individual projects and reports. Explained file on atomic information and materials. Gave instruction on how to gather information for projects. Introduced,

Date	Experimental Sec. 3	Control Sec. 6
	Introduced, showed and discussed film The Atom and Biological Science. Discussed possible field trips to Cancer lab and physics lab.	discussed subject matter that was in the film The Atom and Biological Science. Discussed possible field trips.
Wed. Jan. 11	Introduced and showed film Carbon 14. Reshowed because of lack of understanding, discussed.	Discussed content of film Carbon 14. Used diagrams on board as well as charts. (Difficult lecture) Went over information several times.
Thurs. Jan. 12	No class. School Assembly.	Same as for experimental group.
Fri. Jan. 13	Few minutes review at start of period. Remainder of period used for study and work period on projects, helped students locate materials and organize outlines of their projects.	Same as for experimental group.
Mon. Jan. 16	Short review for the first part of period. Study period, work on projects.	Same as for experimental group.
Tues. Jan. 17	Showed and discussed the film A is for Atom. Reshowed and discussed.	Discussed content of film A is for Atom. Used diagrams, went into detail with explanations.
Wed. Jan. 18	Introduced, showed, and discussed film Atom Smashers. In follow-up discussion the students showed need for reshowing. Reshowed and discussed.	Discussed in detail content of film Atom Smashers. Diagramed and explained different types of reactor or piles.

Date	Experimental Sec. 3	Control Sec. 6
Thurs. Jan. 19	(Seniors were out of class on "work day.") Showed film The Atom Goes to Sea. Reviewed discussion of power for transportation.	(Seniors were out of class on "work day.") Discussed content of film The Atom Goes to Sea. Diagramed and discussed power reactor and atomic power for transportation.
Fri. Jan. 20	Teacher demonstrations and experiments on the nature of radiation using "Class-master" count rate meter and radioactive isotopes.	Same as for experimental group.
Mon. Jan. 23	Discussed Fridays demonstrations. Explained in more detail the "inverse square law." Study and work period.	Same as for experimental group.
Tues. Jan. 24	Work period, helped some students polish reports to be given orally.	Same as for experimental group.
Wed. Jan. 25	Student oral reports. Reviewed Ch. 37 & 38.	Same as for experimental group.
Thurs. Jan. 26	Student oral reports, discussed these reports. After school went on field trip to physics dept. to see Van de Graaff generator, cloud chamber, and other related demonstrations by Dr. Swanson.	Same as for experimental group.
Fri. Jan. 27	Final study, work and preparation period.	Same as for experimental group.

Date	Experimental Sec. 3	Control Sec. 6
Mon. Jan. 30	Student oral reports given. Discussed these reports.	Same as for experimental group.
Tues. Jan. 31	Posttest given, Silhouette and factual knowledge.	Same as for experimental group.
Wed. Feb. 1	Remainder of posttests given, all-answers-correct and matching tests.	Same as for experimental group.
Wed. Feb. 29	Four weeks after posttests were given the retention tests were given.	Same as for experimental group.
Thurs. Mar. 1	Finished giving retention tests.	Same as for experimental group.

Daily Record For "Organic Chemistry and Petroleum" Topic

Date	Experimental Sec. 6 2:10 P.M. daily	Control Sec. 3 10:30 A.M. daily
Wed. Mar. 14	Pretests given, Silhouette, factual knowledge, and all-answers-correct tests.	Same as for experimental group.
Thurs. Mar. 15	Introduced concepts of organic chemistry. Distributed dittoed reference sheets on nomenclature.[1]	Same as for experimental group.
Fri. Mar. 16	Discussed organic chemistry outline. Introduced, discussed, and showed film Oil For Aladdin's Lamp.	Discussed organic chemistry outline. Discussed content of film that was shown to experimental group.

---

[1] See Appendix E for copy of this.

Date	Experimental Sec. 6	Control Sec. 3
Mon. Mar. 19	Introduced film Crude Oil Distillation. Discussed and diagramed old and new ways of distillation. Showed film. Discussed varied products from crude oil.	Discussed variety of products from crude oil, explained and diagramed the different fractional distillation processes. Discussed content of film Crude Oil Distillation.
Tues. Mar. 20	Selected and organized projects and reports on organic chemistry.	Same as for experimental group
Wed. Mar. 21	Introduced and showed films Refining Oil for Energy and Birth of an Oil Field. Discussed both films.	Discussed content from detailed outline of two films Refining Oil for Energy and Birth of an Oil Field.
Thurs. Mar. 22	Demonstrated and discussed models of organic molecules and showed how petroleum molecules are built. Discussed with diagrams oil drilling, discovery, and geology.	Same as for experimental group.
Fri. Mar. 23	Work period. Text assignment. Handed out five pamphlets on petroleum.	Same as for experimental group.
Mon. Mar. 26	Introduced and showed films Prospecting for Petroleum and Patterns for Chemicals. Discussed films in detail.	Discussed methods of prospecting and drilling for oil, forming of hydrocarbons and naming of branched chains. Discussed film content.
Tues. Mar. 27	Work period on projects and reports.	Same as for experimental group.
Wed. Mar. 28	Reviewed, discussed, naming of chains, branches and ring compounds.	Same as for experimental group.

Date	Experimental Sec. 6	Control Sec. 3
Thurs. Mar. 29	Reviewed quiz and homework on chapters 28 & 29.	Same as for experimental group.
EASTER VACATION		
Mon. Apr. 9	Introduced and showed films Evolution of the Oil Industry and Gasoline for Everybody. Discussed and returned homework. Assigned and introduced Ch. 30.	Discussed content of films shown to experimental group. Discussed and returned homework. Assigned and Introduced Ch. 30.
Tues. Apr. 10	Work period on lab projects.	Same as for experimental group.
Wed. Apr. 11	Discussed and lectured on Ch. 30. Derivitives, substitutions, and addition of organic products.	Same as for experimental group.
Thurs. Apr. 12	Teacher demonstrated, prepared, and tested methane, acetylene, organic oxides, esters, etc.	Same as for experimental group
Fri. Apr. 13	Reviewed demonstrations, cleared up concepts, assigned question related to Ch. 30.	Same as for experimental group.
Mon. Apr. 16	Reviewed Ch. 28, 29, & 30.	Same as for experimental group.
Tues. Apr. 17	Work period on projects.	Same as for experimental group.
Wed. Apr. 18	Final work, study and review period.	Same as for experimental
Thurs. Apr. 19	Reviewed first part of period. Gave posttests of silhouettes, and all-answers-correct tests.	Same as for experimental group.

Date	Experimental Sec. 6	Control Sec. 3
Fri. Apr. 20	Gave rest of posttests, factual knowledge test. Introduced next unit of study.	Same as for experimental group.
Fri. May 18	Gave all tests as retention tests. (Four weeks after the posttests.)	Same as for experimental group.

APPENDIX E

Subject Matter Content Outlines

P. K. Yonge Laboratory School

Chemistry Department

VALENCES OF COMMON POSITIVE IONS

VALENCE OF 1

Ammonium	NH_4
Cuprous	Cu
Hydrogen	H
Mercurous	Hg
Potassium	K
Silver	Ag
Sodium	Na

VALENCE OF 2

Barium	Ba
Cadmium	Cd
Calcium	Ca
Cobalt	Co
Cooper	Cu
Ferrous	Fe
Lead	Pb
Magnesium	Mg
Manganous	Mn
Mercuric	Hg
Nickel	Ni
Stannous	Sn
Strontium	Sr
Zinc	Zn

VALENCE OF 3

Aluminum	Al
Antimonous	Sb
Arsenious	As
Bismuth	Bi
Chromium	Cr
Ferric	Fe
Phosphorous	P

VALENCE OF 4

Carbon	C
Manganic	Mn
Plumbic	Pb
Stannic	Sn
Sulfur	S

VALENCE OF 5

Antimonic	Sb
Arsenec	As
Phosphoric	P

VALENCES OF COMMON NEGATIVE IONS

VALENCES OF -1

Acetate	$C_2H_3O_2$
Bicarbonate	HCO_3
Bromide	Br
Chlorate	ClO_3
Chloride	Cl
Cyanide	CN
Fluoride	F
Hydroxide	OH
Nitrate	NO_3
Iodide	I
Nitrite	NO_2
Permanganate	MnO_4
HypoClorite	ClO

VALENCES OF -2

Carbonate	CO_3
Chromate	CrO_4
Dichromate	Cr_2O_7
Oxalate	C_2O_4
Oxide	O
Silicate	SiO_3
Sulfate	SO_4
Sulfite	SO_3
Sulfide	S
Tartrate	$C_4H_4O_6$

VALENCES OF -3

Arsemate	AsO_4
Citrate	$C_6H_5O_7$
Phosphate	PO_4

DISPLACEMENT, OF ACTIVITY, OR ELECTROMOTIVE SERIES OF COMMON METALS
(ALL POSITIVE VALENCES)

1. Lithium
2. Potassium
3. Calcium
4. Sodium
5. Magnesium
6. Aluminum
7. Manganese
8. Zinc
9. Chromium
10. Iron
11. Cacmium
12. Cobalt
13. Nickel
14. Tin
15. Lead
16. Hydrogen
17. Copper
18. Arsenic
19. Antimony
20. Bismuth
21. Mercury
22. Silver
23. Platinum
24. Gold

THE FOUR TYPES OF CHEMICAL REACTIONS

1. Simple union, or direct combination.
2. Displacement of one element by a more active element (plus).
3. Double displacement (Metathesis) two elements displaced by two more active elements.
4. Decomposition of a compound due to some outside influence, such as heat, light, or electricity.

WELL-KNOWN ACIDS

Nitric	HNO_3
Hydrochloric	HCL
Sulfuric	H_2SO_4
Hydrofluoric	HF
Hydrobromic	HBr
Hydriodic	HI
Phosphoric	H_3PO_4
Acetic	$HC_2H_3O_2$
Boric	H_3BO_3
Sulfurous	H_2SO_3
Malic	$H_2C_4H_4O_5$
Citric	$H_3C_6H_5O_7$
Tattaric	$H_2C_4H_4O_6$
Hydrocyanic	HCN
Hydrosulfuric	H_2S
Carbonic	H_2CO_3

HALOGENS (-1)
(Producers of salt)

Fluoride	F
Chloride	Cl
Bromide	Br
Iodide	I

DIOTOMIC ELEMENTS

H_2 O_2
N_2 Cl_2
Fl_2 Br_2
I_2

P. K. YONGE LABORATORY SCHOOL

ORGANIC CHEMISTRY OUTLINE

Name__________________________________Section_______ Date__________

HYDROCARBONS

I. ACYCLIC (chain and branched hydrocarbon molecules) Aliphatic compounds-non-aromatic.

A. METHANE SERIES (general formula C_nH_{2n+2}) ANE-single carbon bonds -$\overset{|}{\underset{|}{C}}$--$\overset{|}{\underset{|}{C}}$-

SATURATED (All carbon bonds have hydrogen atoms.)

1. METHANE CH_4
2. ETHANE C_2H_6
3. PROPANE C_3H_8 Also known as paraffins
4. BUTANE C_4H_{10}
5. PENTANE C_5H_{12}

Etc., by using the Greek prefixes and the ANE (single bond) suffix.

B. ETHENE SERIES (general formula C_nH_{2n}) ENE = double carbon bonds -$\overset{|}{C}$=$\overset{|}{C}$-

UNSATURATED (Not all carbon bonds have hydrogen atoms.)

(Methene is impossible, why?)

1. ETHENE C_2H_4 ----Ethylene
2. PROPENE C_3H_6 ----Propylene Old names Also known
3. BUTENE C_4H_8 ----Butylene as
4. PENTENE C_5H_{10} ----Pentylene petroleums

Etc., by using the Greek prefixes and the ENE (double bond) suffix.

C. ETHYNE SERIES (general formula C_nH_{2n-2}) YNE ≡ triple carbon bonds -C≡C-

UNSATURATED (Not all carbon bonds have hydrogen atoms.)

(Methyne is impossible, why?)

1. ETHYNE C_2H_2 ----Acetylene Also known
2. PROPYNE C_3H_4 ----Methyl acetylene Old as
3. BUTYNE C_4H_6 ----Ethyl acetylene names alkynes
4. PENTYNE C_5H_8 ----Propyl acetylene

Etc., by using the Greek prefixes and the YNE (triple bond) suffix.

II. CYCLIC (Ring hydrocarbon compounds) Aromatic compounds. BENZENE SERIES (general formula C_nH_{2n-6}) made up of alternate single and double bonds between carbon atoms.

UNSATURATED (All carbon bonds do not contain hydrogen atoms.)

1.	BENZENE	C_6H_6		
2.	METHYLBENZENE	C_6H_5; CH_3	(Toluene)	
3.	(1, 2) DIMETHYLBENZENE	$C_6H_4(CH_3)_2$	(O-Xylene)	Old
4.	(1, 3) DIMETHYLBENZENE	"	(M-Xylene)	names
5.	(1, 4) DIMETHYLBENZENE	"	(P-Xylene)	
6.	ETHYLBENZENE	C_6H_5 C_2H_5		

III. ORGANIC OXYGEN COMPOUNDS (Derived from hydrocarbons when one or more hydrogen atoms have been replaced by the hydroxyl radical (OH).

A. ALCOHOLS (Derivatives of the Methane series of hydrocarbons. General formula C_nH_{2n+1}+OH or R-OH.)

1.	METHANOL	CH_3OH	methyl alcohol	methane
2.	ETHANOL	CH_3CH_2-OH	ethyl alcohol	ethane
3.	PROPANOL	CH_3-CH_2-CH_2-OH	normal propyl	propane
4.	GLYCEROL	$C_3H_5(OH)_3$	glycerine	propane
5.	BUTANOL	CH_3-CH_2-CH_2-CH_2-OH	butyl alcohol	butane

B. ORGANIC ACIDS (Characterized by the presence of the carboxyl group--COOH. General formula R-COOH.)

	International Name	Common Name	Formula
1.	Methanoic	Formic	HCOOH
2.	Ethanoic	Acetic	CH_3COOH
3.	Propanoic	Propionic	C_2H_5COOH
4.	Butanoic	Butyric	C_3H_7COOH
5.	Pentanoic	Valeric	C_4H_9COOH
6.	Hexanoic	Caproic	$C_5H_{11}COOH$
7.	Heptanoic	Enanthic	$C_6H_{13}COOH$
8.	Octanoic	Caprylic	$C_7H_{15}COOH$
9.	Nonanoic	Pelargonic	$C_8H_{17}COOH$
10.	Decanoic	Capric	$C_9H_{19}COOH$
16.	Hexadecanoic	Palmitic	$C_{15}H_{31}COOH$

GREEK ALPHABET AS USED FOR NUMBER PREFIXES IN ORGANIC CHEMISTRY

1. one (Meth)
2. two (Eth)
3. three (Prop or tri)
4. four (But or Tetra)
5. five (Pent)
6. six (Hex)
7. seven (Hept)
8. eight (Oct)
9. nine (Non)
10. ten (Dec)

GENERAL INFORMATION ON RADIOISOTOPES

Parts of the Nucleus

Name of Part	Symbol	Mass	Charge	Radiated From
Alpha particle	α	4, Helium nucleus	++(2 protons in nucleus)	reactors
Beta particle (electrons and positrons)	β	1/1850 of $_1H^1$ atom negligible	- electron + positron	P^{32}, Uranyl nitrate
Gamma Ray (similar to X-ray and cosmic rays	γ	0, not a particle but considered a wave	0, not considered to have a charge but will cause ionization.	I^{131}, X-ray, cosmic rays radium ores, background radiation from natural sources.
Proton	P	1, basic unit of mass	+	makes up charge of nucleus as well as part of the mass
Neutron	N	1, considered same unit as P	0, no charge	helps make up mass of nucleus with protons (cyclotron)

Some Abbreviations and Symbols Used Frequently

A --Activity
α --Alpha
β --Beta
C^{14} --Carbon (radioisotope)
c/m --counts per minute
dis/min --disintegrations per minute
e^- --electron
γ --gamma
G-M tube--Geiger-Muller counter

I^{131} --Iodine (radioisotope)
μc --microcurie
mc --millicurie
N --neutron
ν --Nutreino
p^{32} --Phosphorus (radioisotope)
e --Positron
P --Proton
d --thickness

Some General Laboratory Techniques and Precautions For Using Radioisotopes in High School

1. Handle radioisotopes as you would strong acids and bases.

2. Always place newspaper or other thick absorbing paper on lab table.

3. Wash thoroughly all equipment used--if any glassware still shows a high c/m store it on a top shelf of stockroom for several weeks or months.

4. Never place any equipment or radioisotope in the mouth--never use mouth pipetting.

5. Store radioisotopes on high, inaccessible shelf of the stock room.

6. Always wash hands after handling radioisotopes--use rubber gloves if working with more than 10 microcuries.

7. The glass walls of storage bottles are sufficiently thick to stop most rays from 10 microcurie lots of radioisotopes.

8. No real danger can come from handling 10 microcurie lots of most isotopes (unless taken internally).

9. It would take 113,000 hours per week exposure to gamma rays from 10 microcuries of a radioisotope at a distance of 1 meter to get the permissible dose of 300 milliroentgens per week for an indefinite period of time. (This is for the entire body.)

10. It is impossible to get a dangerous dose of radiation from a 10 microcure of P^{32} or I^{131}, even if held in the hand--the rate of decay (half-life) would prevent a harmful amount of radiation.

11. If any radioisotope is spilled on the hands or clothing it should be washed as an added precaution.

12. Any radioisotope spilled on the lab table (not covered with paper) should be washed.

13. A properly marked waste container should be provided for all contaminated paper and solid waste. After several months if may be disposed of in the ordinary manner.

14. Liquid waste may be poured down a drain and flushed with water if it is not too hot. Hot liquid wastes may be buried.

15. Bottles or other containers of radioactive material in the laboratory should be clearly marked and dated.

16. The learning of proper handling techniques should be part of the training along with the laboratory experiments. Even though the student may be handling harmless amounts of radioactive material the correct techniques should be stressed, at some future time the student may be working with "hotter" stuff.

BIBLIOGRAPHY

Books

Beck, Samuel Jacob. Rorschach's Test. 2d ed. New York: Grune and Stratton and Co., 1949.

Brubacher, John S. Modern Philosophies of Education. 2d ed. New York: McGraw-Hill Book Co., Inc., 1950.

Cantril, H. Understanding Man's Social Behavior. Princeton, N. J.: Office of Public Opinion Research, 1947.

Dale, Edgar. Audio-Visual Methods in Teaching. New York: Dryden Press, Inc., 1946.

Dale, Edgar, Finn, James D., and Hoban, Charles F., Jr. "Audio-Visual Materials," Encyclopedia of Educational Research, ed. Walter S. Monroe. rev. ed. New York: Macmillan Co., 1952.

Dull, Charles E., Brooks, William O., and Metcalfe, H. Clark. Modern Chemistry. New York: Henry Holt and Co., 1954.

Guilford, J. P. Fundamental Statistics in Psychology and Education. 2d ed. New York: McGraw-Hill Book Co., Inc., 1950.

Hoban, Charles F., Jr. Focus on Learning; Motion Pictures in the School. Washington, D. C.: American Council on Education, 1942.

________. Movies That Teach. New York: Dryden Press, Inc., 1946.

Hoban, Charles F., Hoban, Charles F., Jr., and Zisman, Samuel B. Visualizing the Curriculum. New York: The Corban Co., 1937.

Ittelson, William H., and Cantril, Hadley. Perception, A Transactional Approach. (Doubleday Papers in Psychology No. 7) Garden City, New York: Doubleday and Co., Inc. 1954.

Kelley, Earl C. Education for What is Real. New York: Harper and Brothers, 1947.

Kelley, Earl C., and Rasey, Marie I. Education and the Nature of Man. New York: Harper and Brothers, 1952.

Kinder, James S., and McClusky, F. Dean. The Audio-Visual Reader. Dubuque, Iowa: William C. Brown Co., 1954.

Klopfer, Bruno, et al. Developments in the Rorschach Technique. Yonkers-on-Hudson, New York: World Book Co., 1954.

Klopfer, Bruno. The Rorschach Technique. Yonkers-on-Hudson, New York: World Book Co., 1942.

Knopf, Alfred A. Projective Psychology. New York: Alfred A. Knopf, 1950.

Knowlton, D. C., and Tilton, J. W. Motion Pictures in History Teaching. New Haven, Conn.: Yale University Press, 1924.

Lindquist, Everet F., et al. Educational Measurement. Washington, D. C.: American Council on Education, 1951.

Lindquist, Everet F. First Course in Statistics. New York: Houghton Mifflin and Co., 1942.

McNemar, Quinn. Psychological Statistics. 2d ed. New York: John Wiley and Sons, Inc., 1955.

Miles, John R., and Spain, Charles R. Audio-Visual Aids in the Armed Services, Implications for American Education. Washington, D. C.: American Council on Education, 1947.

Mons, Walter E. R. Principles and Practice of the Rorschach Personality Test. 2d ed. Philadelphia, Penna.: J. B. Lippincott Co., 1951.

Packard, Vance. The Hidden Persuaders. New York: David McKay Co., 1957.

Simmons, Leo William, and Wolff, Harold G. Social Science and Medicine. New York: Russell Sage Foundation, 1954.

Smith, Samuel (ed.). "Educational Psychology," College Outline Series. New York: Barns and Noble, Inc., 1956.

Snygg, Donald, and Combs, Arthur Wright. Individual Behavior. New York: Harper and Brothers, 1949.

Walker, Helen M., and Lev, Joseph. Statistical Inference. New York: Henry Holt and Co., 1954.

Webster's New Collegiate Dictionary. 6th ed., Springfield, Mass.: G. and C. Merriam Co., 1953.

Wood, B. D., and Freeman, F. N. Motion Pictures in the Classroom. New York: Houghton Mifflin Co., 1929.

Periodicals

Combs, Arthur W. "Counseling as a Learning Process," Journal of Counseling Psychology, I (Winter 1954), 31-6.

________. "Intelligence From a Perceptual Point of View," Journal of Abnormal and Social Psychology, XLVII (July, 1952), 662-73.

Moldstad, John. "Doctoral Dissertations in Audio-Visual Education," Audio-Visual Communication Review, IV (Fall 1956), 291-333.

Norberg, Kenneth. "Perception Research and Audio-Visual Education," Audio-Visual Communication Review, I (Winter 1953), 18-29.

Miscellanecus

Krebs, Robert E. "Survey of Research in Audio-Visual Education." Unpublished Bibliography, Library, College of Education, University of Florida, 1955. (Typewritten.)

Master Vu-Graph (overhead projector) East Orange, N. J.: Charles Beseler Co., 219 South 18th St.

Thurstone, L. L., and Thurstone, Thelma Gwinn. Psychological Examination for High School Students. Washington, D. C.: American Council on Education, 1948.

VanderMeer, Abram W. Relative Effectiveness of Instruction by: Films Exclusively, Films Plus Study Guides, and Standard Lecture Methods. Port Washington, L. I., New York: Technical Report-SDC269-7-13 of the Special Devices Center, July, 1950.

BIOGRAPHICAL SKETCH

Robert E. Krebs was born August 4, 1922, at Shippensburg, Cumberland County, Pennsylvania. He attended the public schools of Shippensburg and graduated from high school in 1940. He attended the State Teachers College at Shippensburg from 1940 to 1942 and again from 1946 to 1948 and received his baccalaureate degree in August, 1948, in the field of secondary education with a major in science and a minor in geography. During the years 1943 to 1946 he was in the United States Army Medical Corps.

Mr. Krebs taught general science and mathematics at Henry Houck Junior High School, Lebanon, Pennsylvania, from 1948 to 1952. During the summers of 1950 through 1952 he attended Western Maryland College, Westminister, Maryland, and was granted the Master of Education degree in August, 1952.

Mr. Krebs taught science in the high school, Callahan, Florida, during the school year 1952-53, and at the P. K. Yonge Laboratory School, College of Education, University of Florida, from 1953 to 1956 and again during the school year 1957-58. He attended the University of Florida as a graduate student from 1952 through 1958 and during the school year 1956-57 he was a full-time graduate student on a fellowship. His area of study was secondary education with major emphasis in the fields of audio-visual education and science education. Mr. Krebs is a member of Phi Kappa Phi, Kappa Delta Pi, and Phi Delta Kappa honorary societies.

This dissertation was prepared under the direction of the chairman of the candidate's supervisory committee and has been approved by all members of that committee. It was submitted to the Dean of the College of Education and to the Graduate Council, and was approved as partial fulfillment of the requirements for the degree of Doctor of Education.

June 9, 1958

J B White

Dean, College of Education

Dean, Graduate School

SUPERVISORY COMMITTEE:

Leon N. Henderson

Chairman

N. E. Bingham

Myron Cunningham

H. L. Knowles

V. A. Hines